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SMITHSONIAN INSTITUTION

THE CRINOIDEA FLEXIBILIA

(With an Atlas of A. B. C. and 76 Plates)

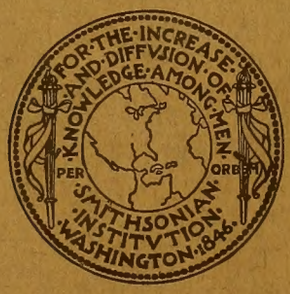
BY

FRANK SPRINGER

LAS VEGAS, NEW MEXICO

ASSOCIATE IN PALEONTOLOGY, U. S. NATIONAL MUSEUM

PLATES



(Publication 2501)

CITY OF WASHINGTON

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EXPLANATION OF PLATES

All figures, except those upon Plates A, B, C, and XXI, unless otherwise noted, are made from light prints of photographs direct from the specimens, finished with India ink brush drawings. They are reproduced by the heliotype process. Enlargements, if any, are indicated by an improper fraction placed at the right lower corner of each figure; if not so distinguished the figure is of natural size. Figures of each specimen have a common serial number, different views being designated by a small letter after the number. If but one figure is given, it bears a number without lettering; thus "fig. 3" indicates that there is no other view of that specimen, while "3*a*" shows that one or more other views are given. All specimens not otherwise noted are in the author's collection, now at the United States National Museum, Washington, D. C.

PLATE A

Larval Development of Existing Crinoids

Symbols on this and next two plates: B = basal; R = radial; IBr = primibrach; RA = radianal; iR = interradial; An = anus; p = perisome; x = anal (radianal).

PAGE

Figs. 1-6. **Antedon bifida** (Pennant) [*rosaceus auctt.*] 80

Fig. 1. Skeleton of Pentacrinoid larva at incipient brachial stage with orals opened; dried specimen, showing reticulate structure of the plates, with anal plate *x* in the zone of radials, resting on posterior basal and encroaching upon side of right posterior radial. (After W. B. Carpenter, pl. 41, fig. 1.) × 30.

2. Pentacrinoid larva at later stage, with centrodorsal and cirri well developed, almost ready to cast off the stem. Anal *x* detached from the radials (which are nearly closed beneath it), and lifted from beneath them by the growth of the anal tube *a*, to which it is attached. See note on p. 81. (After W. B. Carpenter, pl. 40, fig. 2.) × 30.

3. Opposite view of same specimen, with one ray removed to show the oral apparatus; orals, *o, o,* now completely separated from radials, and relatively carried inward by the development of the membraneous perisome, *p*. (After W. B. Carpenter, pl. 40, fig. 1.) × 30.

4. Skeleton of Pentacrinoid larva at stage with ventral side closed by the folding together of the orals, *o, o;* cirri just beginning to appear. (After W. B. Carpenter, pl. 39, fig. 1.) × 35.

5. Early Pentacrinoid larva, spirit specimen, with orals opened but with tentacular apparatus retracted, showing basals, radials and rudimentary primibrachs; cirri not yet developed. (After W. B. Carpenter, pl. 39, fig. 1A.) × 15.

6. Similar specimen at somewhat later stage than the last; showing incipient development of arms from the IBr, and the relative increase in size of radials. (After W. B. Carpenter, pl. 39, fig. 1B.) × 15.

7. Hypothetical figure of primitive Flexibilia calyx; with infrabasals, radianal, anal *x* between radials, and two primibrachs—for comparison with figures on this and two succeeding plates. (From author's paper of 1906, Jour. Geology, XIV, pl. 5, fig. 9.)

Fig. 8. **Holopus rangii** d'Orbigny 82

Fig. 8. View of the disk with closed orals, *o, o,* perforated; small plates at base of arms separate the orals from the radials. (After P. H. Carpenter, Challenger Rep. St. Crin., pl. 3, fig. 2.) × $\frac{5}{2}$.

Fig. 9. **Thaumatocrinus renovatus** P. H. Carpenter 83

Figs. 9*a, b*. View of the disk from above; showing the pyramid of closed orals, marginal zone of small plates between orals and interradials, and the anal tube with its appendage of strong plates; the protuberances seen between the arm-bases are the interradials which separate the radials all around. (After P. H. Carpenter, Phil. Trans. Roy. Soc., 1883, pl. 71, fig. 5.) × 15.

Figs. 10-15. **Promachocrinus kerguelensis** P. H. Carpenter 84

(Larval stages; to be consulted after the figures on Plates B, C)

Fig. 10. Prebrachial stage. Calyx composed almost exclusively of basals and orals; minute radials have appeared, that of the right posterior ray being smaller than the others; the radianal is larger than the radials, having evidently preceded them, and has passed from its primitive position toward the left of r. post. R. × 44.

11. Slightly later stage. Radials are now as large as the radianal, which retains about the same position as in the last figure. × 45.

12. Early brachial stage. Radials much larger than radianal, which is still in the same zone as they are, indenting the left margin of r. post. R; two brachials, the primibrachs, have developed. × 45.

13. Later stage, showing further increase of radial and brachial parts. × 35.

14. Much later stage, in which radials and brachials have further increased in size, and interradials having to some extent the functions of radials have appeared between the regular radials. RA has passed upward beyond the plates of the dorsal side. × 35.

15. Outline drawing showing the points of distinct IBB, which are frequently invisible. × 22. Recent. Collection German South Polar Expedition, steamer *Gauss*. Near Kerguel Islands, Antarctic.

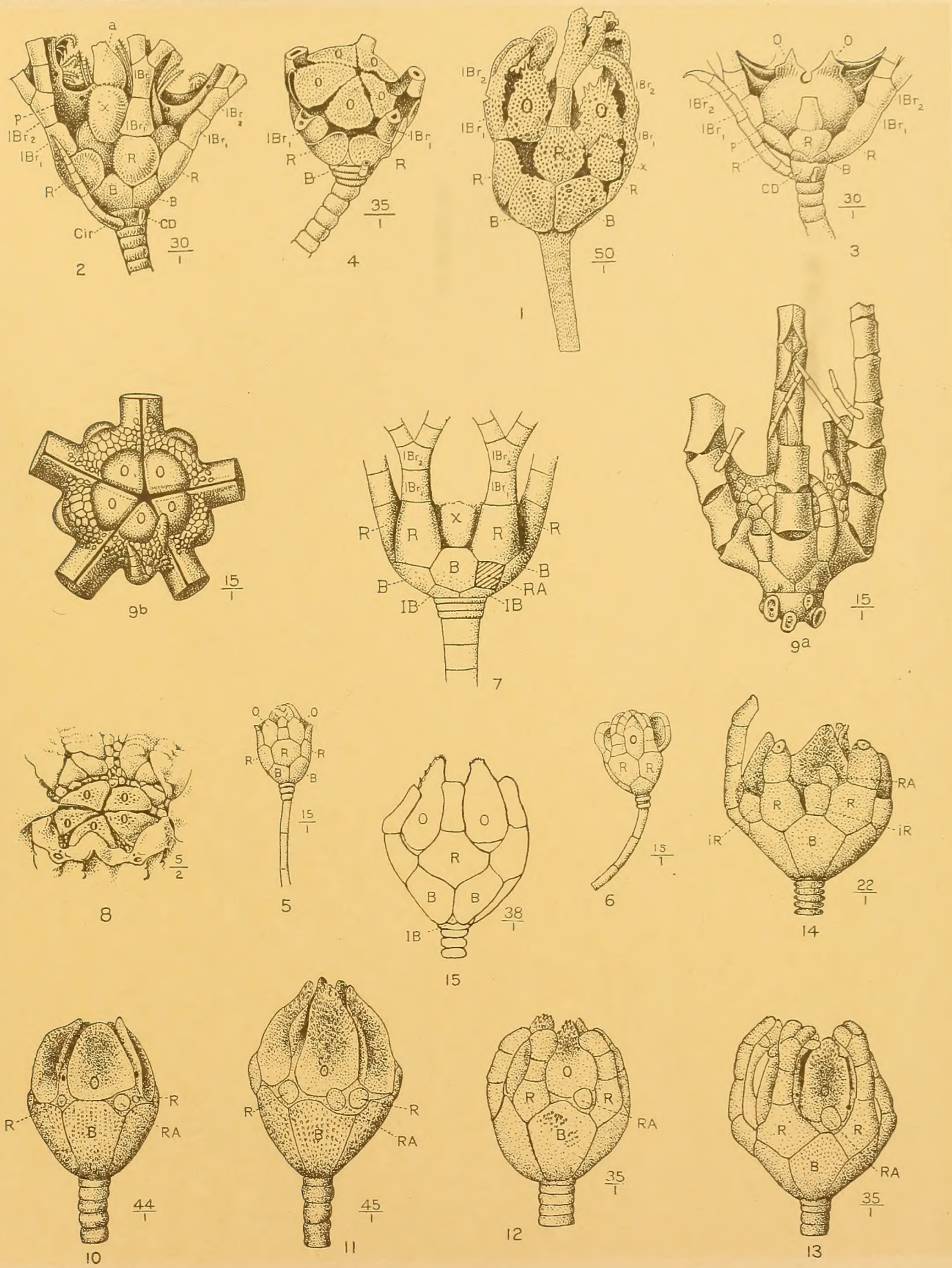

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PLATE B

DEVELOPMENT OF RADIANAL IN LARVAE OF EXISTING CRINOIDS

PAGE

Figs. 1-10. **Comactinia meridionalis** (A. and E. C. Agassiz) 80

Recent. Coast of Yucatan, Mexico.

FIG. 1. Pre-brachial stage. Calyx composed almost exclusively of basals and closed orals, with a few elongate stem ossicles; the plates consisting of a thin calcareous reticulation, translucent, and showing by transmitted light the oesophagus, stomach, and dextrally coiled intestine to which the radianal is attached in the right posterior rhombic space between the corners of radials and basals; patches of stereom smaller than the radianal appear in the other rhombic spaces, which are the incipient radials, but no such plate has appeared in the right posterior space, as yet occupied exclusively by the radianal, which thus preceded the radial in order, and occupies the primitive position at the foot of the right posterior ray. × 95.

2a. Another specimen in the same stage, with orals slightly parted, between the summits of which the oral tentacles, as yet unbranched, project; the radial of the right posterior ray is still wanting, its place being occupied by the radianal attached to the gut at its anal end. × 95.

2b. Outline sketch of same specimen as seen by transmitted light, showing the alimentary system as in fig. 1, except that here the upper margin of the oesophagus is distended by the opening of the orals and therefore smooth instead of wrinkled as in the other specimen. × 95.

3. Specimen in same stage further advanced, with orals opened and tentacles projecting; the right posterior radial has now appeared, with the radianal, still attached to the gut, much larger than the radial and lying obliquely below it; the anal opening of the gut is well shown. × 57.

4. Incipient brachial stage. Small points of stereom in the ray above the radial are the beginnings of the primibrachs; radials have increased in size until they exceed the radianal, which has moved toward the middle of the posterior basal while still strongly indenting the inner margin of r. post. radial. × 50.

5a. Brachial stage. Primibrachs developed and connected with radials by articulation; the anal end of the gut has grown upward to half the height of the orals, carrying the radianal to a level slightly above the radials. × 40.

5b. Anterior side of same specimen. The interradials have now appeared as small patches in the triangular spaces between orals and radials. × 40.

6. Specimen somewhat further advanced, to show the complete stem and its mode of attachment to a cirrus of the host. × 13.

7. Specimen in about the same stage as last. The radials have now met beneath the interradials, and the radianal is about median above posterior basal, but still clearly connected with the right posterior radial by a curved margin. The radials have become larger than the basals. × 30.

8a. Specimen further advanced, with radianal carried still higher up by growth of the gut, and the two posterior radials almost meeting beneath it. × 30.

8b. Lateral view of same specimen, showing great protuberance caused by anal structures. × 30.

9. Specimen still further advanced. Radials now meet at posterior side beneath the radianal, which has been lifted still higher up with growth of the anal tube, and other plates appear at either side of it. × 26.

10. Specimen in which the radianal is connected with radials only by short margins at their shoulders, and is lifted still higher up by the anal tube. × 25. Note the great diminution in size of basal and oral plates in this and next preceding specimens as compared with their condition in figs. 1 and 2.

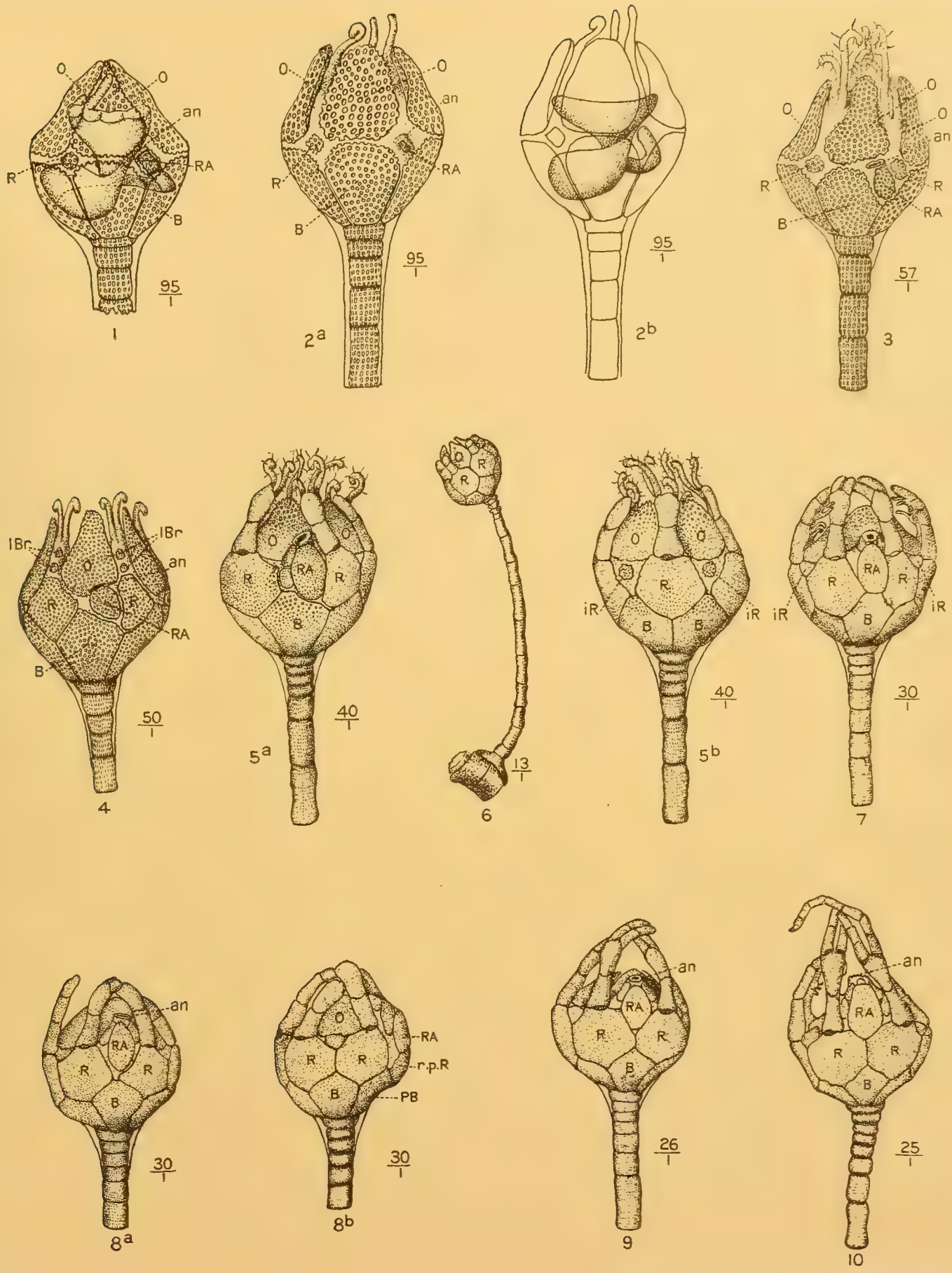

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PLATE C

Further Stages in Development of Comactinia

PAGE

Figs. 1-7. **Comactinia meridionalis** (A. and E. C. Agassiz) 83

Figs. 1*a*, *b*. Incipient cirral stage. Orals form a low pyramid around the mouth, separated by perisome both from basals and radials; short stumps of cirri appear upon the proximal columnal. × 20.

2*a*, *b*. Specimen further advanced, with strong cirri and smaller orals; basals are now small plates lying almost flat. × 20.

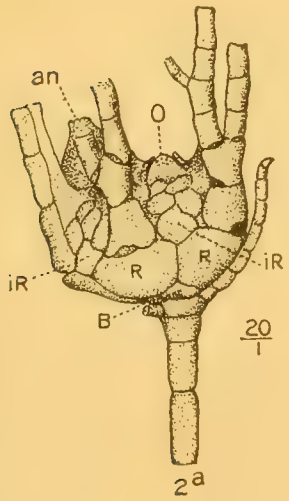
3*a*, *b*. Pinnule stage. Visceral mass, greatly enlarged, enclosed by finely plated perisome, with orals reduced to small triangular plates surrounding the mouth, from which well defined ambulacra pass to the arms; basals have entirely disappeared, and radials are nearly horizontal. About the end of the "pentacrinoid" stage. × 15.

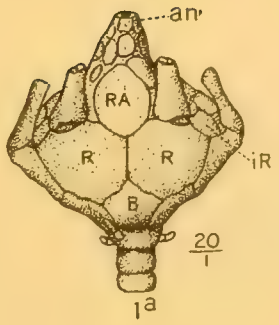
4. Comatulid stage. Stem has been cast off; basals are fused into the centrodorsal, or "Rosette"; the radianal, now separated from the radials, is in process of resorption along with the interradials from which it scarcely differs. The cirri beyond their bases are omitted in the drawing. × 12.

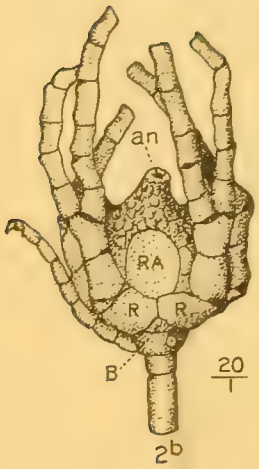
5. Tegmen of an adult specimen, consisting of the granular skin, subcentral anal tube, exocyclic mouth with asymmetric ambulacra both permanently displaced by pressure of the rectum; orals have entirely disappeared. × 5.

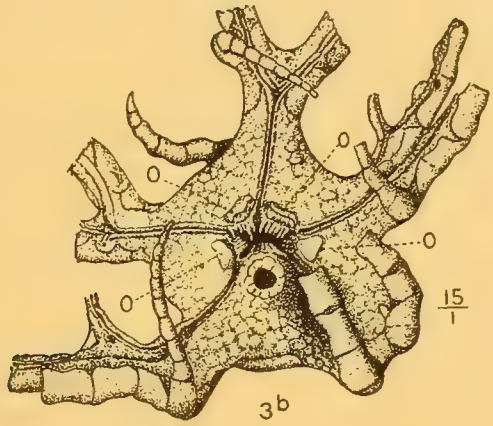
6. Migration of the radianal. Diagrammatic figure based on fig. 1*a*, with dotted line showing course of the plate in the successive larval stages here illustrated, from primitive position under the right posterior radial to the left and upward until eliminated from the calyz. × 20.

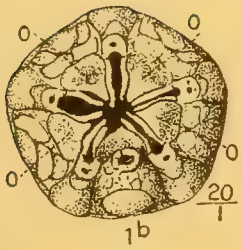
7. Fragment of cirrus showing attachment of two "pentacrinoids" by the flattened base of the stem. × 15.

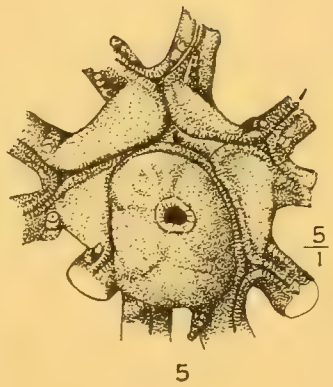


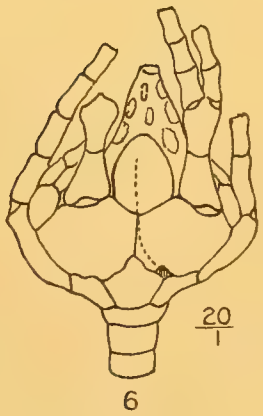


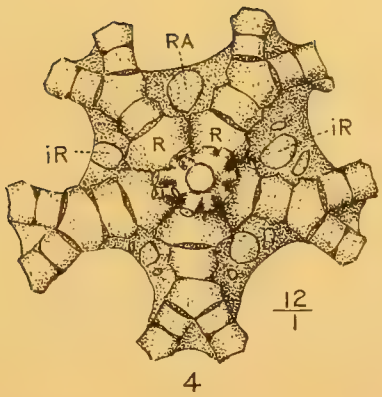


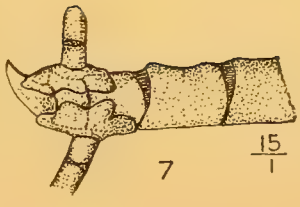












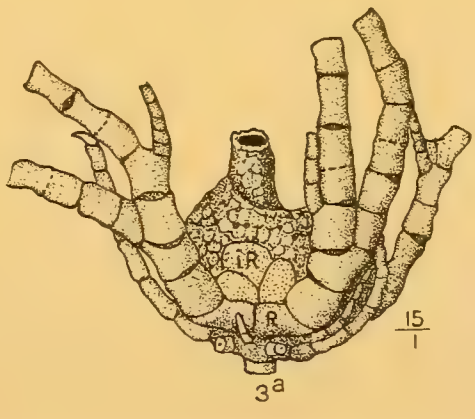


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PLATE I

PAGE

Figs. 1-13. **Lecanocrinus pusillus** Hall..... 131

(All figures natural size except where otherwise stated)

FIGS. 1*a*, *b*. Anterior and posterior views of the type. (28th Regents Rep., pl. 15, figs. 2, 3, 4.) Shows general form and proportions of calyx and anal plate. Am. Mus. Nat. Hist., New York. Waldron, Indiana.

2. Posterior view of abnormal specimen figured by Hall, supposing it to have two anal plates. × 2. Same collection. Waldron, Indiana.

3*a*. The only specimen found with arms preserved; complete crown with part of stem showing alternating joints; lateral view as it lies in the matrix. N. Y. State Museum, Albany. Waldron, Indiana.

3*b*. The same, drawn in erect position to show proportions of calyx and arms.

4*a*. Basal view of specimen from Waldron, showing the shallow, saucer-shaped excavation for the column. × 2.

4*b*. Posterior view of same. × 2.

4*c*. Surface showing the fine reticulate markings.

5. Ventral view of another specimen at distal margin of RR, showing thickness of plates, wide fossæ at articular face, and great strength of calyx. × 2. Waldron, Indiana.

6, 7, 8. Lateral views of three specimens from Waldron, showing slight variation in contour. × 2.

9. Specimen from Waldron with part of rays in place, showing narrow calyx and more acute anal plate than usual × 2.

10. Basal view of abnormal specimen with 3 small IBB, and a fourth larger than the three combined. × 2. Waldron, Indiana.

11. Specimen from the equivalent shales at Newsom, Tennessee, with higher anal plate than usual. × 2.

12, 13. Two other specimens from Newsom with the usual form of anal. Fig. 13, × 2. Niagaran, Waldron shales; Silurian. Indiana and Tennessee.

Figs. 14-36. **Lecanocrinus pisiformis** (Roemer)..... 135

FIGS. 14*a*, *b*, *c*. Anterior, posterior, and distal views of an average specimen with arms complete, showing the great relative height of calyx to top of RR. × 2.

15. Another and similar specimen. × 2.

16. Flattened specimen with proximal part of stem, showing columnals of about uniform width. × 2.

17. Posterior view of a specimen as usually found. × 2.

18. Ventral view of specimen at distal margin of radials, showing the relative thinness of the calyx wall (contrasting with that of *L. pusillus*), and the fossæ. × 2.

19-25. Basal views of a series of specimens, showing the constant abrupt indentation of the column facet. × 2. Fig. 23, from the Gasport beds at Lockport, N. Y., varies from the others in the larger IBB. Fig. 24 is erroneously printed 24*b*.

26. Small specimen with RA smaller than usual. × 2.

27. Small specimen with RA reduced to small triangle. × 2.

28, 29. A small, and an average, specimen in which RA has entirely disappeared. × 2.

30*a*, *b*. Roemer's type, posterior and basal views. It is in the condition of the last two, and the base probably erroneously figured with 5 IBB,—the species being thus founded upon an abnormal and probably weathered specimen. From the same locality as the preceding, where the species is very abundant. Copied from Roemer.

31, 32. Types of *L. hemisphericus* Rowley, from equivalent horizon in Perry County, Missouri, probably of this species. Collection of Prof. R. R. Rowley.

33*a*, *b*. Specimen of similar type from the Laurel limestone at St. Paul, Indiana. Anterior and posterior views of calyx. × 2.

34. Much larger specimen with arms complete, somewhat flattened, from the Louisville limestone, near Louisville, Kentucky; probably a variety of this species representing a mature stage. × 2.

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Figs. 14-36. **Lecanocrinus pisiformis** (Roemer) (continued) 135

Fig. 35. Another specimen from the same locality, not flattened, and with arms not so closely folded. × 2.

36. Similar specimen from same horizon in Perry County, Tennessee, considerably flattened. Niagaran, from Laurel to Louisville, but chiefly Brownsport; Silurian. Tennessee, Indiana, and Kentucky. Specimens not otherwise designated are from the Brownsport limestone, Decatur County, Tennessee.

Fig. 37. **Lecanocrinus meniscus,** n. sp. 140

Figs. 37*a, b, c.* Anterior, posterior, and basal views of the only specimen found, from the lower part of the *Meniscus beds,* below the horizon of the last species. × 2. Niagaran (Brownsport); Silurian. Decatur County, Tennessee.

Unless otherwise stated the specimens figured on this plate are not compressed, and . are in the author's collection.

PLATE II

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-15. **Lecanocrinus billingsi** Angelin..... 132

FIG. 1. Probably the original from which Angelin's pl. 22, fig. 25, was composed, a much flattened specimen with arms complete; posterior view, showing the small RA. × 2.
Snackgardet, Wisby (*d*).

2*a*, *b*. Left anterior and posterior views of smaller specimen, flattened and injured. × 2.

3. Ventral view of another specimen at distal margin of RR. Shows great thickness of plates; fossae on radial facet; and IBB from interior with trilobate rim around the lumen. × 3.

4. Calyx of another specimen showing a faint wrinkled sculpture. × 3.

5, 6. High form, and 7, low form, of calyx. × 2.

8-15. A series of specimens showing irreguarity in position of radianal and anal plates:

8. RA very small and triangular. × 2.

9. RA in primitive position in form of R. under r. post. ray. × 2.

10. RA located vertically below anal *x*. × 2.

11. No RA; post. B large. × 2 (5 other specimens are in this condition).

12. No RA; r. post. B large. × 2.

13. No anal *x*, but RA is normal. × 2.

14. No anal *x*; RA in primitive position in form of R. × 2.

15*a*, *b*. Malformed specimen, with normal RA and anal *x*, but only 3 RR (marked I, II, III). In the ring of BB are 7 plates (marked 1-7) of varying size and form, and a quadrangular plate (+) is seen on the right side between the rings of BB and RR. Outline sketch not exactly drawn to scale. × about $\frac{5}{2}$.

(Out of 134 specimens in the Riks Museum 15—or over 11 per cent—are abnormally developed, showing a tendency to instability of characters much greater than in the preceding Tennessee species.)

Wenlock Gr.; Silurian. Gotland, Sweden.

All specimens are from Wisby, horizon (*d*), and in the Riks Museum, Stockholm, unless otherwise stated.

Figs. 16-21. **Lecanocrinus fascietatus** (Angelin)..... 133

FIG. 16. Specimen of the usual form; posterior view. × 2. Nafdem (*c*).

17*a*, *b*. Specimen of higher form; l. ant. and post. views. × 2. Nafdem (*c*).

18. Specimen from Nafdem (*c*) with anal *x* not so much truncate as usual. × 2.

19*a*, *b*, *c*. Small specimen from Hablingbo (*c*) with high RR and plates thicker than usual; l. ant., post., and distal views. × 2.

19*d*. Granular surface ornament of same, near upper edge of a radial. × 12.

20*a*, *b*, *c*. Anterior, posterior, and distal views of large specimen from Nas (*d*), the last showing thinness of calyx plates. × 2.

21*a*, *b*, *c*. Fragments of arm-ossicles from Wisby (*c*); *a* exterior, × 2; *b*, IBr, from proximal face, × 2; *c*, granular surface, × 12.

Wenlock Gr.; Silurian. Gotland, Sweden.

All specimens in the Riks Museum, Stockholm.

Figs. 22, 23. **Lecanocrinus lindstromi** n. sp..... 134

22*a*, *b*, *c*. The type specimen. Anterior, posterior, and right posterior views of perfect crown. × 2. Hoberg (*d*).

22*d*, *e*. Basal and distal views of same. × 2.

23*a*, *b*, *c*, *d*. Various views of another specimen with a lower cup, from same locality; *d* shows the pentagonal periphery of cup at top of radials. × 2.

Wenlock Gr.; Silurian. Gotland, Sweden.

All specimens in the Riks Museum, Stockholm.

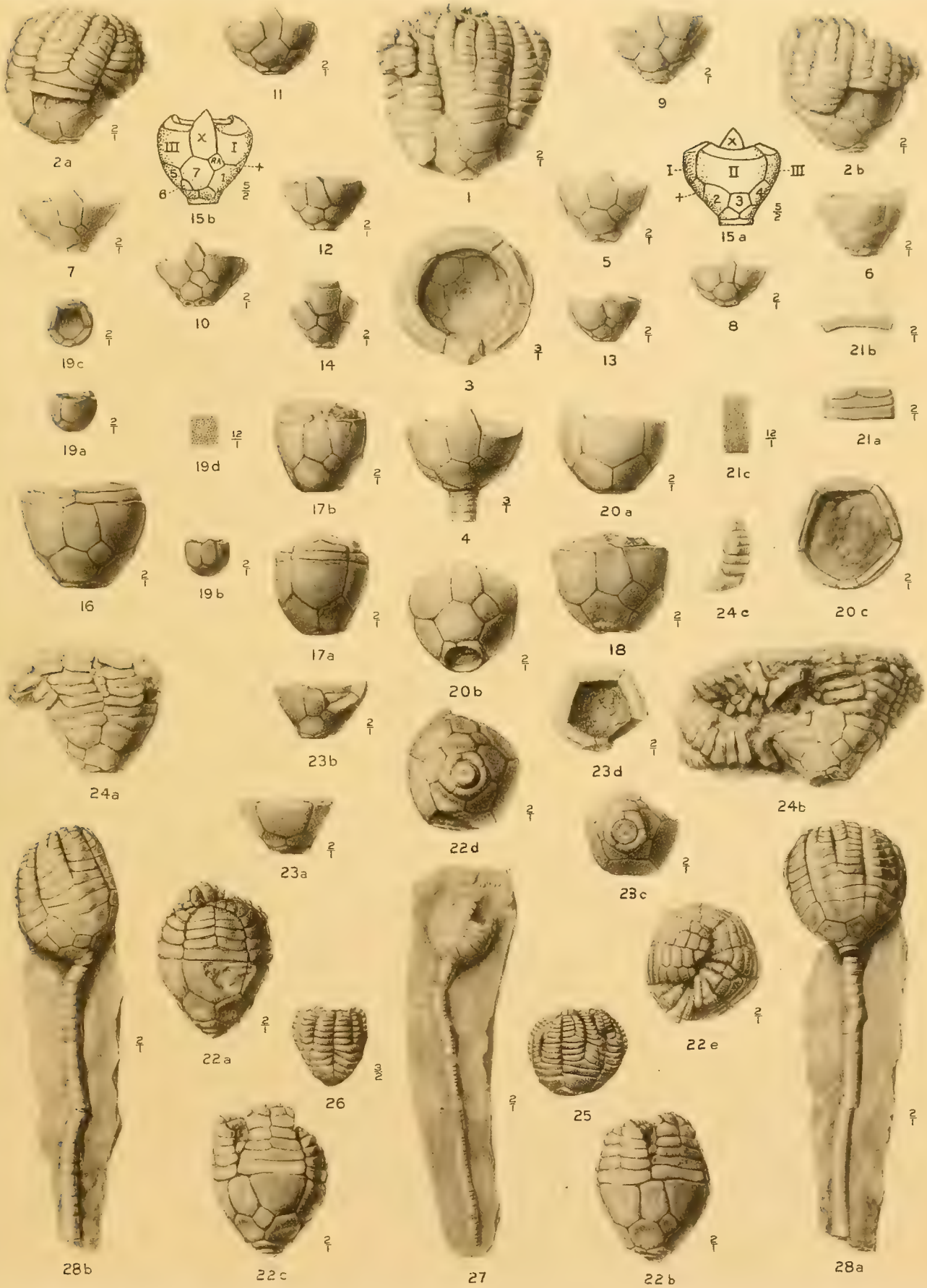

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Fig. 24. **Lecanocrinus angulatus** n. sp. 139

FIG. 24*a*. Lateral view of large specimen from r. post. interradius; flattened, and with arms displaced. Dalhem (*d*).
Riks Museum.

24*b*. Posterior view of same.

24*c*. Part of an arm, showing the angular median ridge; IIAx and IIIBr.
Wenlock Gr.; Silurian. Gotland, Sweden.

Figs. 25-28. **Lecanocrinus bacchus** (Salter MS.) 138

FIG. 25. The type of *Ichthyocrinus bacchus*, Salter's Catalog, p. 126, No. $\frac{A}{528}$ Sedgwick Museum; Cambridge, England; a flattened specimen, natural size.

26. Another specimen in the Sedgwick Museum, labeled under the same name by Salter. ×.

27. Specimen with nearly complete stem. × 2.
British Museum.

28*a*, *b*. Ant. and r. post. views of a specimen in author's collection, with perfect crown and nearly complete stem, showing the relatively small RR, and increasing width of IBr. × 2.
Wenlock Gr.; Silurian. Dudley, England.

PLATE III

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-18. **Lecanocrinus macropetalus** Hall..... 129

FIG. 1. One of the type specimens, original of Hall's pl. 45, fig. 1*b*. An individual of maximum size; posterior view. Am. Mus. Nat. Hist. Lockport, New York.
(The specimens of this and following figures, if not otherwise noted, are more or less flattened by pressure.)

2. Another type, original of Hall's 1*a*. Shows the characters of the stem; not enlarging at the calyx and with columnals alternating from the first. Same locality and collection.

3. Another of Hall's types, fig. 1*c*; r. post. view. Same locality and collection.

4. Maximum specimen showing taper of the arms. Same locality and collection.

5. Basal view of specimen from Grimsby, Ontario, showing large IBB. ×2. Author's collection.

6*a*. Detached IBB plates of specimen from Lockport, New York; exterior view. Author's collection.

6*b*. Interior view of same, showing funnel; the lobes coinciding with IBB. × .

6*c*. Vertical section constructed from this and other specimens, showing the relative positions of the calyx plates.

7. Lateral view of very symmetrical specimen from Grimsby, Ontario. Coll. Sir Edmund Walker; now in the University of Toronto.

8*a*, *b*, *c*. Anterior, posterior, and basal views of specimen from Grimsby, with a peculiar raised border parallel to margin of plates. Author's collection.

9. Small specimen from Lockport, with alternating columnals from calyx down. Author's collection.

10, 11, 12, 13, 14, 15, 16. A series of specimens in author's collection ranging from maximum to minimum size, from Lockport, all more or less flattened.

17, 18. Two uncompressed specimens, anterior and posterior views; showing true contour of the crown in this species. Same collection.
Niagaran, from the middle Third of the Rochester shale; Silurian. New York and Canada.

Fig. 19. **Lecanocrinus solidus** Ringueberg..... 130

FIG. 19. The type. Original of Ringueberg's fig. 4. Author's collection.
Niagaran (lowest band of Rochester shale); Silurian. Lockport, New York.

Figs. 20-25. **Lecanocrinus waukoma** (Hall)..... 140

20*a*, *b*. Lateral and basal views of type, after Hall. From an internal cast, the plates being dissolved by chemical action.

21, 22, 23. Basal and lateral views of three specimens from Milwaukee, all internal casts, showing the concave base. Author's collection.

24*a*, *b*. Posterior and basal views of similar specimen with part of arms;—same locality and collection.

25. The largest specimen; figured by Weller, pl. 15, fig. 6. University of Chicago.
Niagaran (Racine); Silurian. Chicago, Ill.

Fig. 26. **Lecanocrinus magnaradialis** (Weller)..... 143

FIGS. 26*a*, *b*, *c*. The type. Original of Weller's figure (as *Ichthyocrinus*); anterior, posterior, and right posterior views. IBB entirely within column facet. University of Chicago.
Helderbergian; Lower Devonian. New Jersey.

Figs. 27-29. **Lecanocrinus soyei** Oehlert..... 142

FIGS. 27*a*, *b*. Posterior and summit views of type, after Oehlert; showing surface ornament; IBB not visible in side view. (Musée d'Hist. Nat. Laval Mayenne, France.)

28*b*. Posterior and basal views of less conical specimen in author's collection, with larger IBB. Same locality.

29. Lateral view of smaller specimen with strong surface ornament. Same locality and collection.
Lower Devonian. Sablé, France.

K.M. Chapman del.

Heliotype & B. Stern

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Figs. 30-32. **Lecanocrinus roemeri** Schultze 141

FIGS. 30*a, b, c.* The principal type specimen, original of Schultze's figs. 8, 8*a, b;* posterior, basal, and distal views; IBB at bottom of basal cavity covered by column; very small RA. Mus. Comp. Zool., Harvard.

31. Lateral view of another type, Schultze's fig. 8*c;* with larger RA. Author's collection.

32. Another specimen with still larger RA. Schultze's fig. 8*g*, showing the abrupt excavation of the base. Mus. Comp. Zool., Harvard.

Middle Devonian. Kerpen, Eifel, Germany.

PLATE IV

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-22. **Asaphocrinus ornatus** (Hall) 176

FIG. 1*a*. One of the cotypes, original of Hall's fig. 2*a*, a mature flattened specimen; posterior view; shows proportions of calyx and rays, and the suturally connected anal *x* with incipient ridge followed by narrow, tube-like plates, the latter with space for perisome at either side. Collection Cornell University, Ithaca, N. Y.

1*b*. Outline restoration of same specimen, showing correct contour if undistorted.

2. Another cotype, original of Hall's fig. 2*b*; anterior view. Am. Mus. Nat. Hist.

3, 4. Posterior views of flattened specimens, to show condition of anal *x* with the longitudinal ridge, and succeeding plates; the first has a misleading appearance of radiating ridges upon the basal plates, due to accidental pressure of foreign objects, or to work of parasites. × 2.

5. Similar specimen showing a number of small plates in irregular order above anal.

6*a*. Very young specimen with arms short and immature (perhaps recuperated), preserving the surface ornament; anterior view. × 2.

6*b*. Detail of same enlarged, showing character of ornament on radial. × 4.

7*a*. Another young specimen, with surface ornament. × 2.

7*b*. Ornament of a IBr. × 4.

8, 9, 10, 11, 12. A series of specimens with arms folded, in various attitudes and sizes, all more or less flattened, and all showing the tube-like anal and following plates.

13. Small undistorted specimen, showing contour of calyx, and proportions of alternating columnals. × 2.

14, 15. Flattened specimens with arms more or less extended.

16, 17. Specimens with arms separated from vertical pressure, showing rather wide iBr spaces; fig. 17 shows how the arms contract to very slender finials beyond the third bifurcation.

18, 19. Specimens with stem almost complete; also showing contraction of the arms beyond the secundibrachs.

20. Specimen but little flattened, with arms, stem, and branching root complete.

21. Young specimen with stem nearly complete, showing elongated columnals characteristic of that stage.

22. Type of *Lecanocrinus nitidus* Ringueberg, with arms completely extended to their hair-like finials, and lower part of stem with expanded, branching root. A minute specimen of *Homocrinus parvus*, with arms complete, is lodged in the right ramus of the middle ray.

Rochester shales; Silurian. Lockport, New York.

Figs. 23-29. **Asaphocrinus excavatus** (Ringueberg) 177

FIG. 23. Ringueberg's type specimen, with arms, stem, and root complete, somewhat flattened.

24, 25, 26. Specimens with calyx more turbinate, and with straighter sides than most of the preceding.

27, 28, 29. Specimens with wider interbrachial spaces, and remnants of perisome (poorly preserved at this locality), showing tendency toward the Tennessee form. Fig. 27, r. ant. iR. × 2; fig. 28, r. post. iR; fig. 29, r. ant. iR.

Rochester shales; Silurian. Lockport, New York.

Fig. 30. **Asaphocrinus incisus** (Ringueberg) 178

FIG. 30. The type, with arms and large part of stem attached; antero-lateral interradial view. A single IBr in two rays.

Rochester shales; Silurian. Lockport, New York.

All the specimens figured on this plate are from Lockport, New York, and all except Hall's types, figs. 1 and 2, are in the author's collection.

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PLATE V

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-3. **Mespilocrinus forbesianus** de Koninck and Le Hon..... 192

FIGS. 1*a, b*. The principal type specimen, after de Koninck and Le Hon, pl. 2, figs. 1*a, c;* left posterior and posterior views, "somewhat enlarged," showing dextrose twist of arms, and unequal sides of IBr. Musée Royal d'Hist. Nat. Bruxelles.

2. Basal view of another specimen from the same locality and collection. By oversight, or owing to obliteration of sutures, the infrabasal disk is drawn as if it were undivided, although the generic diagram based upon these specimens shows the usual three plates. After de Koninck and Le Hon. Enlarged.

3*a*. Mature specimen with complete crown and part of stem, lateral view. The short columnals extend farther down than in the American species. British Museum Nat. Hist., No. 40125.

3*b*. The same crown placed in a more erect position.

Lower Carboniferous, Tournai Stage. Tournai, Belgium.

Figs. 4-15. **Mespilocrinus konincki** Hall..... 194

FIG. 4. The type, with crown drooping upon the stem; showing rapid lengthening of columnals. From a cast in Am. Mus. Nat. Hist., New York.

5. A specimen of average size, with drooping crown and nearly complete stem; showing the change in columnals from very short, cylindrical disks to very long spindles, ten times as long as their diameter at the sutures.

6, 7. Similar specimens.

8. Similar but very young specimen; the long columnals beginning much nearer the calyx than in the others. × 2.

9*a, b*. Posterior and basal views of small crown. × 2.

10. Distal view of similar specimen showing twist of arms. × 2.

11. Basal view of very small specimen with 5 IBB. × 2.

12. Large specimen, somewhat flattened, from r. post. radius. × 2.

13*a, b*. R. ant. and l. post. views of large, slightly flattened specimen; showing the unsymmetrical RR and Br, and the wedge-form columnals due to fixed curvature of the stem. × 2.

14*a, b*. The type of *M. scitulus* Hall, showing 5 unequal IBB; posterior and basal views.

15*a, b*. Posterior and basal views of specimen from Sedalia, Missouri, figured by Miller and Gurley as *M. blairi;* Bull. Ill. St. Mus., pl. 4, figs. 13-15.

Lower Burlington limestone; Lower Carboniferous. Burlington, Iowa.

All specimens except that of figures 4, 14 and 15, are in the author's collection.

Figs. 16-19. **Mespilocrinus blairi** (Miller and Gurley)..... 196

FIGS. 16*a, b*. The type; basal and posterior views showing 5 IBB. After Miller and Gurley. Location of specimen unknown.

17*a, b*. Posterior and distal views of specimen figured by Miller and Gurley, Bull. 8, Ill. St. Mus., pl. 3, figs. 13, 14. After Miller and Gurley.

18, 19. Two specimens from the same horizon and locality as the preceding, now in the University of Chicago; showing the usual 3 IBB.

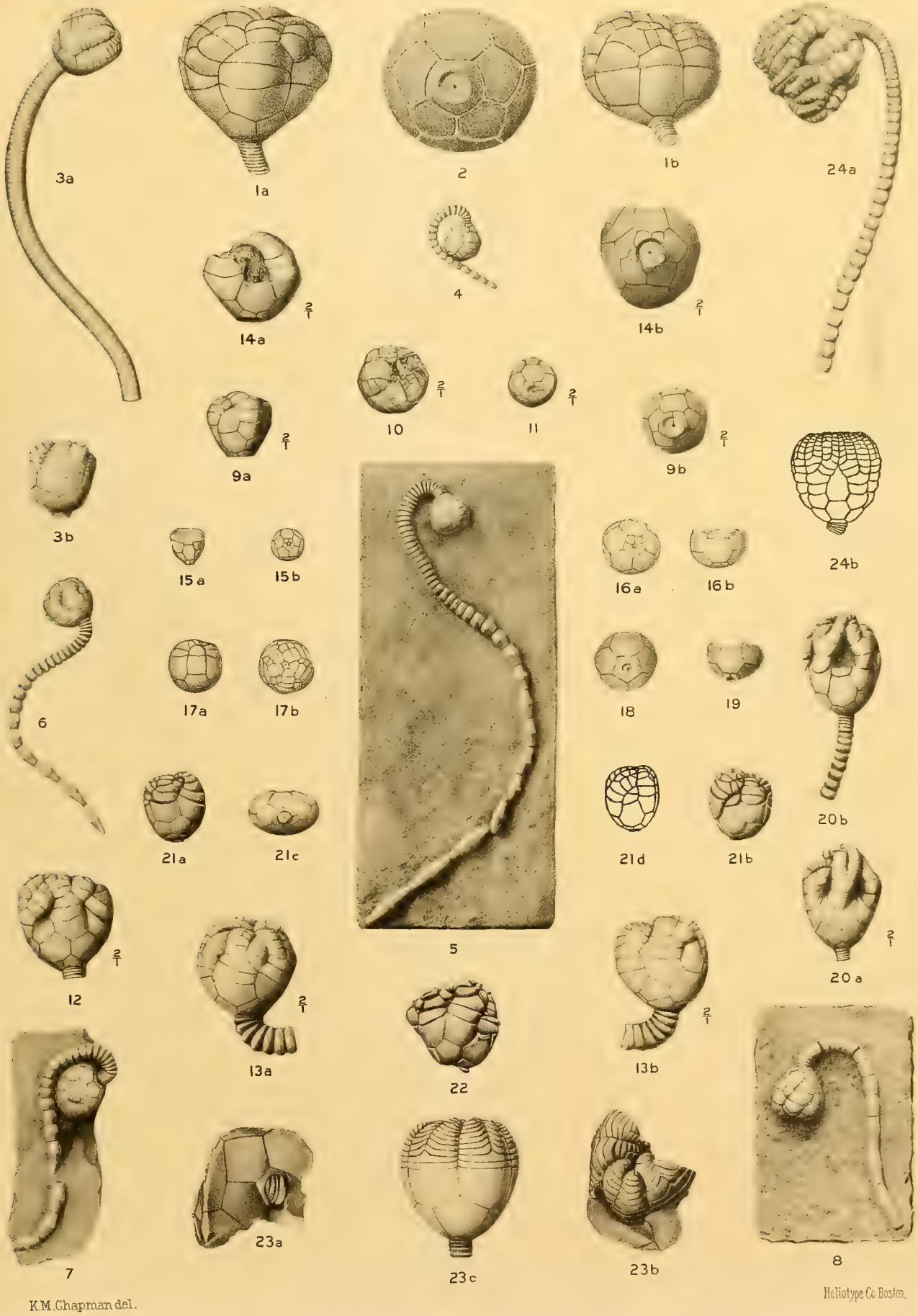
Choteau beds; Lower Carboniferous. Sedalia, Missouri.

Fig. 20. **Mespilocrinus thiemei** n. sp..... 198

FIG. 20*a*. The type, anterior view; IBr narrower than in the other species. × 2. Author's collection.

20*b*. Posterior view of same; anal *x* very short, probably followed by others. × 2.

Lower Burlington limestone; Lower Carboniferous. Burlington, Iowa.



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Figs. 21-22. **Mespilocrinus romingeri** n. sp. 196

FIGS. *21a, b, c.* Anterior, posterior and basal views of type, somewhat flattened.
21d. Outline restoration, giving true contour of crown.
22. Another flattened specimen; anterior view.
New Providence shales; Knobstone, Lower Carboniferous. Button Mould Knob, Kentucky.
Both specimens are in the author's collection.

Fig. 23. **Mespilocrinus bordeni** n. sp. 197

FIGS. *23a, b.* Basal and distal views of the type, much distorted by pressure. Author's collection.
23c. Restoration from accurate measurements, giving form and proportions of the plates, and correct contour of crown.
New Providence shales; Knobstone, Lower Carboniferous. Clark County, Indiana.

Fig. 24. **Mespilocrinus chapmani** n. sp. 199

FIG. *24a.* The type. Nearly complete specimen with crown, somewhat flattened, and large part of stem; columnals become elongate but not spindle-shaped. Author's collection.
24b. Outline restoration of crown, showing natural contour.
Upper Burlington limestone; Lower Carboniferous. Burlington, Iowa.

PLATE VI

(All figures natural size except where otherwise stated) PAGE

Figs. 1-12. **Homalocrinus parabasalis** Angelin..... 154

FIGS. 1*a, b.* The type, from l. ant. radius and anal side; original of Angelin, pl. 16, figs. 29, 30, showing the two main divisions of the ray with ramules to the inside; RA barely visible between r. post. R. and IBr. × 2. Riks Museum. Gotland (*f*).

1*c.* Basal view of same; BB covered by IBB, except small angular points. × 2.

1*d.* R. post. view of base, showing small RA more distinctly. × 2.

2*a, b, c.* Posterior, basal and distal views of young specimen with RA and all BB covered by growth of IBB. × 2. Riks Museum. Wisby (*f*).

3*a.* Specimen from Dudley, England, somewhat flattened, with RA under r. post. R; posterior view. × 2. Author's collection.

3*b.* Basal view of same, showing RA distinctly and BB well exposed. × 2.

4. Another specimen from Dudley, with RA prominently visible above IBB. × 2. Author's collection.

5. Similar specimen with RA and BB prominent; posterior view. Natural size. British Museum, E. 7426. Dudley.

6, 7, 8. L. post., and post. views of specimens with only points of BB, and no RA, visible above IBB. Natural size. British Museum, E. 1422, 57258, 57476. Dudley.

9. Nearly complete flattened specimen, r. post. view; RA not visible and only small points of BB; showing also character of stem with strong, alternating joints diminishing from the calyx. × 2. Author's collection. Dudley.

10. Anterior view of similar specimen with stem, showing well the heterotomy of the rays. Natural size. Author's collection. Dudley.

11. Flattened specimen in same condition. Natural size. Same collection and locality.

12. Sketch constructed from the above specimens to show how RA may be concealed by the growth of IBB, while leaving points of BB visible—e. g. in cases where IBB reach the dotted line b—b, as in figs. 6, 7, 9; if they only reach a—a, BB will be seen connecting and RA well exposed, as in figs. 3*a*, 5; while if they grow higher than b—b, neither RA nor BB can be seen, as in figs. 2*a, b*, or only post. B, as in fig. 13*b*.
Wenlock Gr.; Silurian. Gotland and England.

Figs. 13-15. **Homalocrinus liljevalli** n. sp..... 155

FIG. 13*a.* The principal type, r. ant. radial view; all BB, except posterior, covered by growth of IBB; lower ramule enlarged and bearing secondary ramules; 2 rows of iBr in upper part of interradius. × 2. Author's collection. Wisby (*d*).

13*b.* Basal view of same. × 2.

14*a.* R. ant. view of smaller specimen, with more of BB exposed; IBB broken off. Author's collection. × 2. Wisby (*d*).

14*b.* Basal view of same, showing space formerly occupied by inner part of IBB, within ring of BB; RA concealed by IBB when in place. × 2.

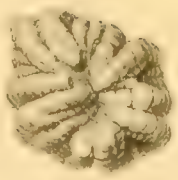
15*a.* Specimen with calyx broken away just below the tegmen; lateral view of part of rays: o = outer ramus, i = inner. × $\frac{3}{2}$. Riks Museum. Wisby (*d*).

15*b.* View of same from below, showing under side of finely plated tegmen with 5 oral plates in the middle, and ambulacra passing between them to the arms. × 2.
Wenlock Gr.; Silurian. Gotland, Sweden.

1a

1c

1b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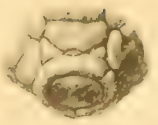
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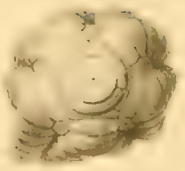
2a

3a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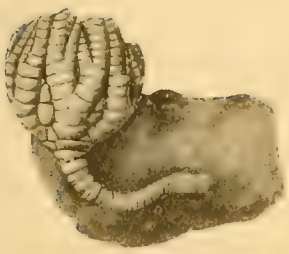
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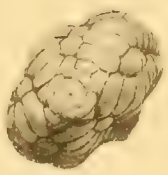

3b

10

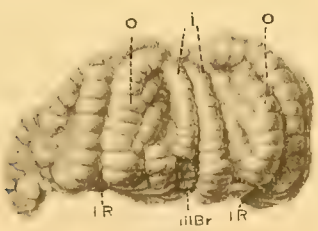
6

12

11

14a

14b



15a

7

8

13a

15b

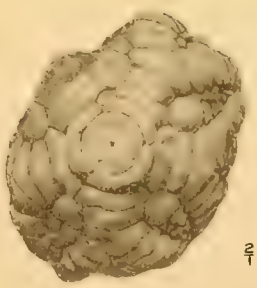

13b

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PLATE VII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-3. **Calpiocrinus intermedius** n. sp..... 156

FIG. 1*a*. A complete specimen with stem and encrusting root, from l. post. radius; inner branch of dichotom reduced in size; all BB except post. covered by IBB; stem with strongly alternating columnals from calyx down. × 2. Author's collection. Dudley, England.

1*b*. Posterior view of same removed from matrix. Natural size.

1*c*. Basal view of same, showing how RR meet above post. B; stem removed at fracture. × 2.

2. Larger flattened specimen, from l. post. interradius, showing same structures. Natural size. British Museum No. 57470. Dudley, England.

3*a*, *b*. Exterior and interior views of fragmentary specimen from Gotland, perhaps of this species, with points of BB slightly exposed. × 2. Riks Museum.

Wenlock Gr.; Silurian. England and Sweden.

Fig. 4. **Calpiocrinus ovatus** Angelin..... 157

FIGS. 4*a*, *b*. The type, original of Angelin, pl. 16, figs. 17-19; anterior and right posterior views. × 2. Riks Museum. Gotland (*f*).

4*c*. Basal view of same showing all BB, except post., covered by IBB. × 2.

4*d*. Axillary brachial on exposed inner arm, at left in fig. 4*a*, with first plate of ramule, from above. × 2.

4*e*. The same from right side. × 2.

4*f*. Similar axillary on inner arm at right of same figure, with first plate of ramule from right side, invisible from the dorsal side; fig. 4*a* also shows smaller size of ramules on the inner arm than on the outer, where they are in plain view. × 4.

Wenlock Gr.; Silurian. Gotland, Sweden.

Fig. 5. **Calpiocrinus heterodactylus** Angelin..... 157

FIGS. 5*a*, *b*, *c*. The type, original of Angelin, pl. 3, fig. 10; anterior, posterior, and left anterior views. × 2. Riks Museum. Gotland (*f*).

5*d*. Basal view of same; all BB covered by IBB. × 2.

5*e*. Detail of arms, at *a*, *b*, *c*, of fig. 5*a*, showing presence of ramules on inner arms, *b* and *c*, but much smaller than those on outer arm *a*. × 2.

Wenlock Gr.; Silurian. Gotland, Sweden.

(?) Fig. 6. **Homalocrinus peculiaris** n. sp..... 159

FIGS. 6*a*, *b*, *c*. Right anterior, posterior, and basal views of an imperfect specimen, with infrabasals broken off. It has but one IBr, and two IIBr; and has a large RA in form of a radial, in r. post. ray. × 2. Author's collection.

Wenlock Gr.; Silurian. Wisby, Gotland, Sweden.

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PLATE VIII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-5. **Calpiocrinus fimbriatus** Angelin..... 158

FIG. 1*a*. One of the type specimens, original of Angelin, pl. 29, figs. 77, 77*a*; from r. ant. radius. Shows ray divided into 4 main rami bearing ramules; BB entirely covered by IBB. × 2. Gotland (*f*).

1*b*. Basal view of same; points of BB exposed by removal of part of IBB, and only post. B visible naturally. × 2.

2*a, b*. Right anterior and posterior views of the other cotype, Angelin, pl. 29, fig. 77*b*. A much smaller specimen; no RA; and BB covered by IBB except small points. × 2. Gotland (*f*).

2*c*. Base of same from l. ant. radius, showing points of BB exposed. × 2.

3. Fragment of specimen in similar condition as last, but with unusually high IBr. × 2. Wisby (*f*).

4*a, b*. Specimen with IBB broken away, showing how the greater portion of BB were covered by them; posterior and basal views. Original of Angelin, pl. 26, figs. 8, 8*a*, figured as *C. heterodactylus*. × 2. Wisby (*f*).

5*a, b*. Right anterior and posterior views of large complete crown from Fara. All BB, including post. B, covered by IBB; part of column attached showing the large, rounded, nearly uniform columnals as in figs. 2*a, b*. Natural size.

Wenlock Gr.; Silurian. Gotland, Sweden.

All specimens in Riks Museum, Stockholm.

Figs. 6-8. **Calpiocrinus rotundatus** n. sp..... 159

FIG. 6*a*. Complete crown with greater part of stem, from right anterior radius. All BB and greater part of RR covered by IBB; stem with distally numerous intercalated thin columnals. × 2. Author's collection. Wisby (*f*).

6*b, c*. Posterior and basal views of same; stem detached at second nodal. × 2.

7*a*. Fine specimen in the Riks Museum, with crown still more rotund; r. post. radial view, showing same stem character as last. × 2. Bara (*f*).

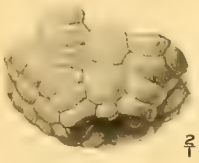
7*b*. Basal view of same; BB, RR, part of IBr and iBr covered by extraordinary growth of IBB. × 2.

7*c*. Base of same with stem and part of IBB removed, showing the plates covered by IBB, and the absence of RA. × 2.

8. Vertical section from radius to interradius, showing relative proportion of plates; composed from figs. 4*b*, and 7*c*; IBB are shaded with vertical lines, too faintly shown in reproduction of the drawing.

Wenlock Gr.; Silurian. Gotland, Sweden.

5a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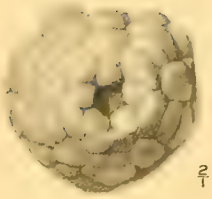
1a 2/1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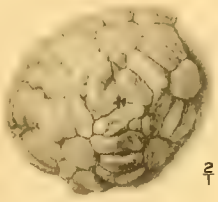
5b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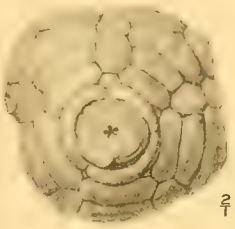
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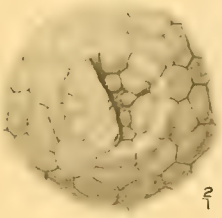
6a

6c 2/1

2b 2/1

2a 2/1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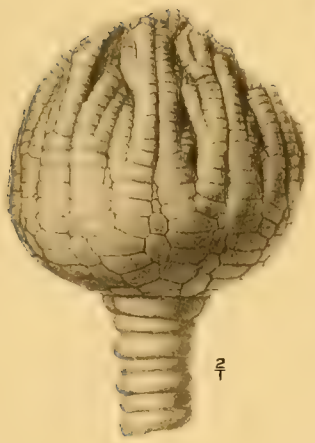
2c 2/1

8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6b 2/1

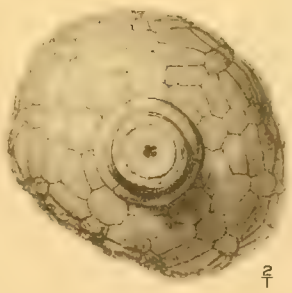
7b 2/1

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PLATE IX

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-4. **Cholocrinus obesus** (Angelin) 173

FIG. 1*a*. The type of Angelin's *Forbesiocrinus obesus*, original of his pl. 21, fig. 18; from right anterior radius, one of the smaller rays filling only about half the distal edge of R. × 3/2.

1*b*. Detail from the same view, showing the plated integument between the rays. × 3.

1*c*. Anal side of same (Angelin, pl. 28, fig. 2); the plates greatly displaced, and anal *x* pushed above line of RR; RA in plain view. × 3/2.

1*d*. Outline sketch to identify the principal calyx plates of last figure.

1*e*. Anterior view of same, showing one of the large rays, filling nearly entire margin of R. × 3/2.

2*a*. Another specimen, from right anterior radius, showing the very small ray curved in under the adjoining ones; plated integument visible at either side. Natural size.

2*b*. Anal side of same, with anal *x* in position, and space for RA, the plate being broken out. × 3/2.

3. Posterior view of complete specimen, with arms, stem, and encrusting root; all plates of anal side in position, and the posterior rays filling almost the entire margins of RR. × 2.

4*a*. A set of arms, broken off from the calyx below the tegmen; figured by Angelin, pl. 26, figs. 6, 6*a*, as *F. divaricatus*. Lateral view from right anterior side, showing the large anterior and right posterior rays, and the small right anterior ray curved under them. × 3/2.

4*b*. Distal view of same specimen, anterior side above, showing the relative size of the rays, how completely dwarfed are the two antero-lateral rays and how enormously overgrown the other three. The respective rays are indicated in this and other figures, by the lettering *a*, *ra.*, etc. (*a* in 4*b* omitted in printing). × 3/2.

4*c*. The same specimen from the opposite aspect, being an interior view of the tegmen, anterior ray below; showing the under side of some ambulacra, and the finely plated interambulacral integument of the disk. × 3.

4*d*. Detail of central part of same. × 3.

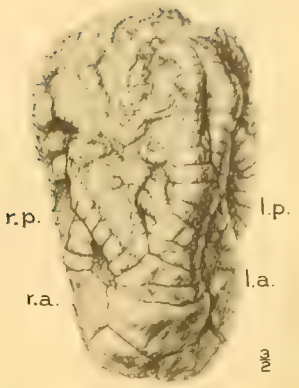
4*e*. Fragment of the same tegmen, seen from the exterior. × 3.

Wenlock Gr.; Silurian. Gotland, Sweden.

All from Follingbo, horizon (*f*), and in the Riks Museum.

1a

1c



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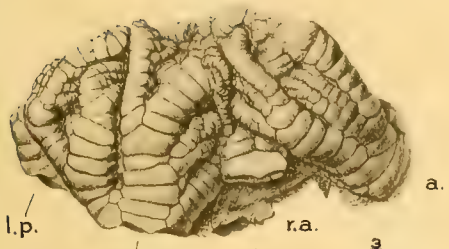

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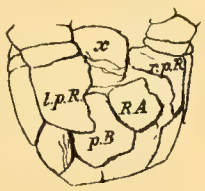

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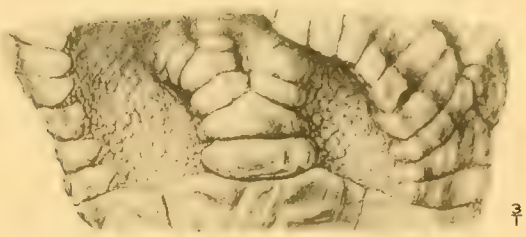

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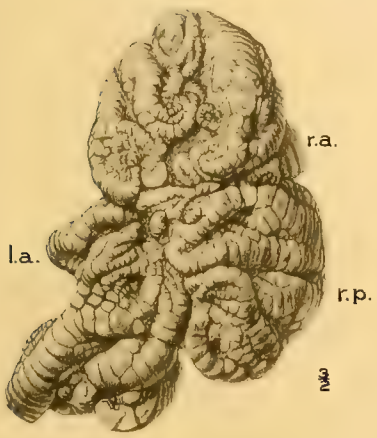

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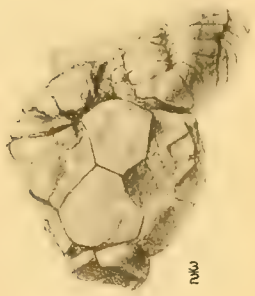

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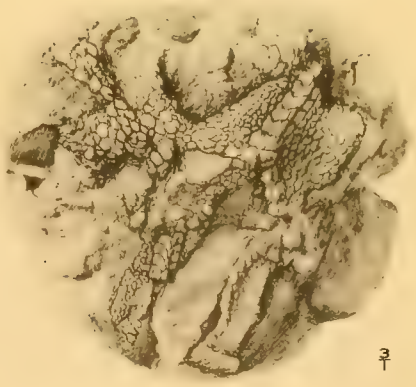

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PLATE X

(All figures natural size except where otherwise stated)

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Figs. 1-3. **Anisocrinus interradiatus** Angelin..... 162

FIG. 1*a*. The type, original of Angelin, pl. 22, fig. 18. Crown minus arms, posterior view; RA large, under r. post. R. × 2. Wisby (*f*).

1*b*. Basal view of same; smaller IB at anterior. × 2.

2*a, b*. Basal and posterior views of similar specimen, found since Angelin. × 2. Wisby (*f*).

3*a, b*. Complete crown found since Angelin, anterior and anal side; showing the full characters of the genus. Note the huge iBr, and swelling of the calyx at the iBr zone, contraction above, and square truncation of the crown distally. × 2. Gotland (*f*).

Wenlock Gr.; Silurian. Gotland, Sweden.

All specimens in the Riks Museum, Stockholm.

Fig. 4. **Anisocrinus angelini** Wachsmuth and Springer..... 163

FIGS. 4*a, b*. The type, original of Angelin, pl. 19, fig. 4, figured as *Lecanocrinus macropetalus*. Complete crown of very small individual, anterior and posterior views. × 3. Riks Museum. Gotland (*f*).

Wenlock Gr.; Silurian. Gotland, Sweden.

Figs. 5-6. (?) **Anisocrinus irregularis** n. sp..... 165

FIG. 5*a*. Crown, with base injured; original of Angelin, pl. 19, fig. 3, and pl. 22, fig. 27, as *Lecanocrinus macropetalus;* posterior view. Has the habitus of the genus, but with heterotomous arms and no RA. × 2. Riks Museum. Gotland (*f*).

5*b*. Anterior ray of same. × 2.

6. Small specimen, r. post. and l. ant. rays. × 2. Riks Museum. Lummelund (*c*).

Wenlock Gr.; Silurian. Gotland, Sweden.

Fig. 7. **Anisocrinus oswegoensis** (Miller and Gurley)..... 164

FIGS. 7*a, b, c*. Left anterior, posterior, and right posterior views of type, figured by Miller and Gurley as *Lecanocrinus*. University of Chicago.

Niagaran; Silurian. Oswego, Illinois.

Figs. 8, 9. **Anisocrinus greenei** (Miller and Gurley)..... 163

FIG. 8. Right posterior view of type, figured as *Lecanocrinus;* the only view of the specimen obtainable, as it lies imbedded in the matrix. University of Chicago. Near Louisville, Kentucky.

9. Much distorted specimen perhaps of this species from Decatur County, Tennessee. Author's collection.

Niagaran (Brownsport); Silurian. Kentucky and Tennessee.

Figs. 10-14. **Asaphocrinus bassleri** n. sp..... 178

FIG. 10*a*. Mature flattened specimen, anterior view; showing strong perisome in iBr areas; 1 and 2 IBr, and 2 IIBr.

10*b*. Posterior view of same. Shows the anal structures, with tube plates somewhat displaced, and strong perisome to the left; anal *x* united by suture to post. B. and RR; strong perisome in l. post. interradius; broad arms; and 2 IIBr.

11. Anterior view of large, nearly complete specimen, considerably flattened, having 1 IBr in the anterior ray, and very strong perisome. It shows the form and proportions of the arms almost to their extremities, and of the proximal part of the stem.

12. Flattened specimen with more of the stem attached, showing elongation and non-alternating of columnals distally. It is a left posterior radial view, and shows the plates of the very large anal tube rising above the level of the second arm bifurcation; has 1 IBr in r. ant. ray.

13. A fine specimen much flattened, with arms complete; l. post. interradial view. Shows large anal and succeeding tube plates with bordering perisome, rays with 1 and 2 IBr and IIBr.

14. Basal view of very large specimen. Shows especially the truncate posterior basal, and sutural connection with it of the large anal plate.

Niagaran, Brownsport limestone; Silurian. Decaturville, Tennessee.

All the specimens are in the author's collection.

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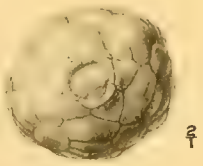
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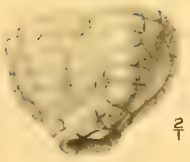
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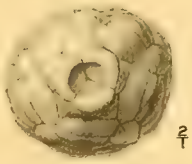
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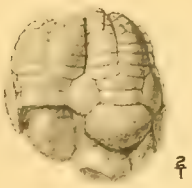
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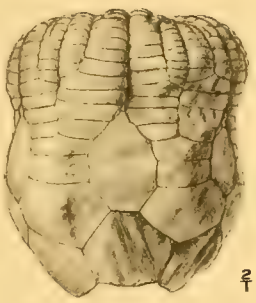
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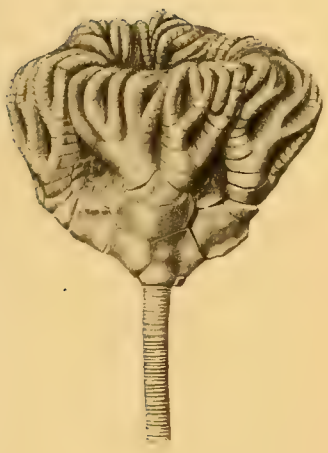
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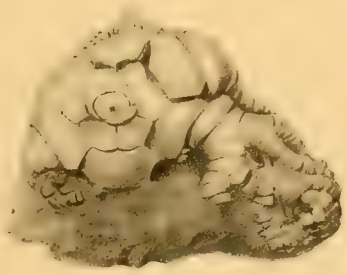
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PLATE XI

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PAGE

Figs. 1-10. **Pycnosaccus scrobiculatus** (Hisinger) 183

FIGS. 1*a, b*. The type; after Hisinger, Leth. Suec., Supp. II, pl. 39, figs. 4*a, b;* lateral and basal views. Locality unknown.

2*a, b*. Left anterior and posterior views of original of Angelin's pl. 15, fig. 10, and of his reconstructed figure 11. × $\frac{3}{2}$. Course of nerve cords is indicated by ridges, the transverse ridge showing the radial commisure. Klinteberg (*f*).

3. Weathered specimen with obscure ridges and higher calyx; anterior view. × $\frac{3}{2}$. Klinteberg (*f*).

4, 5. Two specimens from Klinteberg (*f*); posterior view × $\frac{3}{2}$, distal view × $\frac{1}{1}$.

6*a*. Right anterior view of calyx, with IBr in place,—not an axillary. × $\frac{3}{2}$. Klinteberg (*f*).

6*b*. Distal view of same. Shows IBr not axillary in both r. ant. and l. ant. rays, proving that in this species there may be more than one IBr. × $\frac{3}{2}$.

7. Large fragmentary specimen with calyx and arms. Shows 2 IBr in one ray and 1 in another; surface markings and general proportions of calyx similar to those of the others. Wisby (probably *f*).

8*a, b*. Broken specimen probably of this species, with 2 IBr in some rays; anterior and posterior views. Natural size. Wisby (probably *f*).

9*a, b*. Right anterior and posterior views of specimen from Lau (*f*). It has very sharp surface markings, but lacks the usual depression at angles of plates and the horizontal ridge seen in other specimens. × $\frac{3}{2}$.

9*c*. The distal edge of r. ant. R. and parts of adjoining RR; showing impressions of small perisomic plates in the interbrachial spaces between articular facets (*af*). × 3.

9*d*. Distal edge of anal *x* and parts of the adjoining RR, with similar impressions on anal plate, and on the shoulders of RR. × 2.

10. Angelin's figure of *P. costatus,* much enlarged; probably the young of this species. Wenlock Gr.; Silurian. Gotland, Sweden.

All specimens in the Riks Museum, Stockholm.

Figs. 11-16. **Pycnosaccus nodulosus** Angelin 184

FIGS. 11*a, b*. Right anterior and posterior views of type, original of Angelin's pl. 16, fig. 14. Complete crown with part of stem; abnormal in l. post. ray which has no IBr, the other four having a small, immature IBr under the axillary. × $\frac{3}{2}$. Follingbo (*f*).

12. Specimen with 1 IBr in l. ant. radius, 2 in ant., and an immature plate below axillary in l. post. ray. × $\frac{3}{2}$. Follingbo (*f*).

13. Specimen with 1 IBr in each ray. × $\frac{3}{2}$. Follingbo (*f*).

14*a, b*. Small specimen having distinct ridges like *P. scrobiculatus;* distal view, natural size, posterior view × $\frac{3}{2}$. Klinteberg (*f*).

15*a*. Broken specimen with stem, exposing inner side of two rays and part of tegmen. × $\frac{3}{2}$. Follingbo (*f*).

15*b*. The rays and tegmen further enlarged, showing the ambulacra with extremely small covering plates, which can be seen also on the ventral side of the coiled arm. × 4.

16*a, b, c*. An abnormal specimen perhaps of this species. Has RA in primitive position in form of a radial; anal *x* much reduced and pushed partly above the line of radials; anterior, posterior, and basal views. × $\frac{3}{2}$. Lau (*f*).

Wenlock Gr.; Silurian. Gotland, Sweden.

All specimens in the Riks Museum, Stockholm.

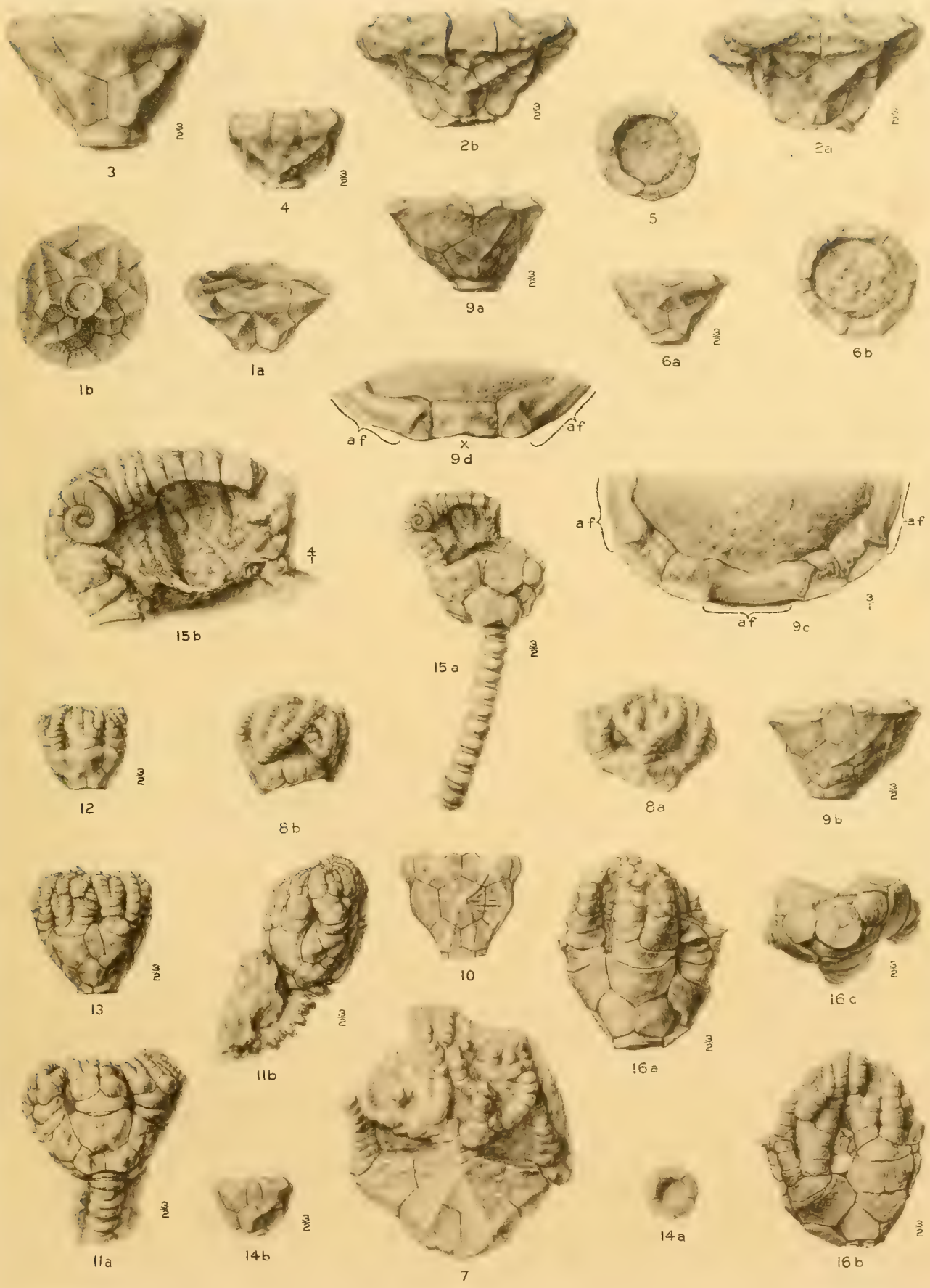

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PLATE XII

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Figs. 1-9. **Pycnosaccus patei** n. sp. 186

FIG. 1. Mature specimen, not compressed; left posterior view. Shows about the average characters of the calyx ridges, radial facets, one IBr, and arms; distal ends of arms seen coiled in iBr spaces. The specimen was not quite vertically posed for drawing, and the calyx appears relatively too high.

2a. Smaller specimen showing plated perisome in iBr spaces; right anterior radial view. Natural size.

2b. Right posterior interradius, showing detail of perisome resting on shoulders of RR; parts of distal ends of arms also visible. × 2.

2c. Posterior view of same specimen, giving almost the correct relative proportion of the calyx; height to width about 1 : 1.5.

3a. Upper part of calyx, with arms, of specimen having interbrachial perisome intact in natural position. Note the sharp projecting nodes on some of the plates. Natural size.

3b. Detail of iBr area of same. × 2.

4. Specimen with nearly complete stem.

5a, b. Anterior and basal views of strongly marked specimen, slightly compressed vertically.

6, 7. Anterior and left posterior views of young and of mature specimen showing the general characters. The latter has an abnormal growth at posterior side, as if an anus through the calyx wall.

8. The largest specimen; having ridges obscure, but showing the relatively small, angular arms.

9a, b. Anterior and posterior views of much eroded specimen from same beds at another locality; without ridges, and with much more rounded arms than the preceding.

Niagaran (Brownsport); Silurian. Decaturville, Tennessee.

All the specimens are from a bed of fine grained, shaly clay; and are in the author's collection.

Figs. 10-11. **Pycnosaccus bucephalus** Bather (MS.) 187

FIG. 10*a*. A very mature specimen, slightly flattened; posterior view. It has complete crown and large part of stem; surface ridges broad and rounded; plates massive, and arms heavy. British Museum, No. E5625.

10b. Anterior view of same, showing ridges somewhat plainer.

11. Lateral view of a larger crushed specimen, with ridges more obscure; IBr displaced. British Museum, No. E7427.

Wenlock Gr.; Silurian. Dudley, England.

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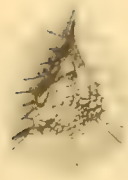

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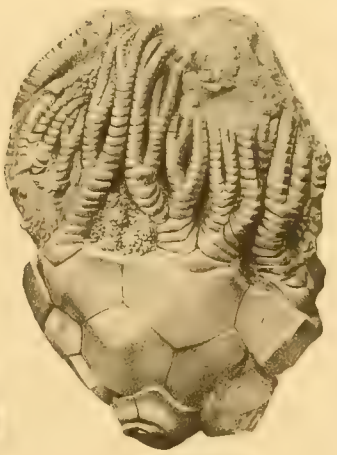

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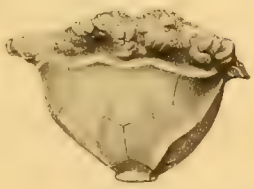

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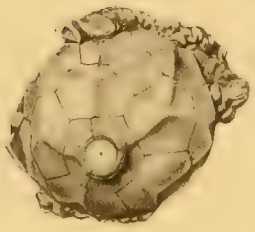

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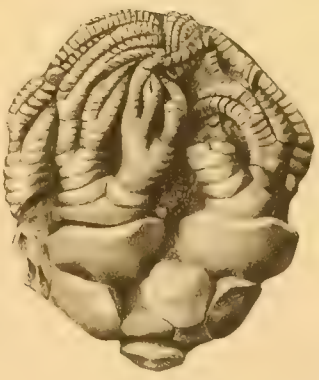

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PLATE XIII

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Figs. 1, 2. **Pycnosaccus tenuibrachiatus** n. sp. 187

FIGS. 1*a*, *b*. Left anterior and right posterior views of undistorted crown. Shows the small, short arms, and straight horizontal margin of radials; the surface markings are destroyed by chemical action, only a slight trace of the radial ridges remaining. Author's collection.

2. A larger specimen, somewhat flattened, with ridges fairly well preserved; from r. post. radius. Author's collection.

Helderbergian, Keyser; Lower Devonian. Keyser, West Virginia.

Figs. 3-5. **Pycnosaccus welleri** n. sp. 188

FIG. 3*a*. Nearly complete specimen with crown flattened, from r. ant. interradius. Shows the small IBB and BB, very large RR, long arms, and 3 or 4 IBr.

3*b*. Left posterior radial view of crown; anal plate displaced.

3*c*. Restoration of crown in natural contour.

4*a*. Right anterior interradial view of a larger flattened crown.

4*b*, *c*. Posterior and basal views of same.

5*a*, *b*. Lateral and opposite views of much larger, crushed specimen.

Niagaran, Brownsport; Silurian. Decatur County, Tennessee.

All the specimens are in the author's collection.

Figs. 6-9. **Pycnosaccus calyculus** (Hall) 185

FIG. 6. The type. Posterior view of calyx. Am. Mus. Nat. Hist., New York.

7*a*. Specimen with arms and stem complete; posterior view, showing curved anal plate above the line of radials, and the rounded arms. Author's collection.

7*b*. Anterior view of same.

8. Another calyx, showing form of anal plate. Author's collection. Lockport, New York.

9*a*, *b*. Posterior and basal views of specimen from Chicago, figured by Weller as *Lecanocrinus waukoma*, perhaps of this species.

Niagaran; Silurian. New York and Illinois.

Fig. 10. **Pynosaccus americanus** Weller 188

FIG. 10. The type. Posterior view of calyx. University of Chicago.

Niagaran, Racine; Silurian. Chicago.

Fig. 11. (?) **Pycnosaccus dubius** n. sp. 189

FIG. 11*a*. The only specimen. It is complete, but the calyx plates are displaced, so that their arrangement cannot be fully ascertained; the anal side is entirely unknown. Author's collection.

11*b*. Outline restoration of plates as far as possible; showing IBB, BB, large RR, 3 short IBr, and apparently no iBr.

Niagaran, Brownsport; Silurian. Decatur County, Tennessee.

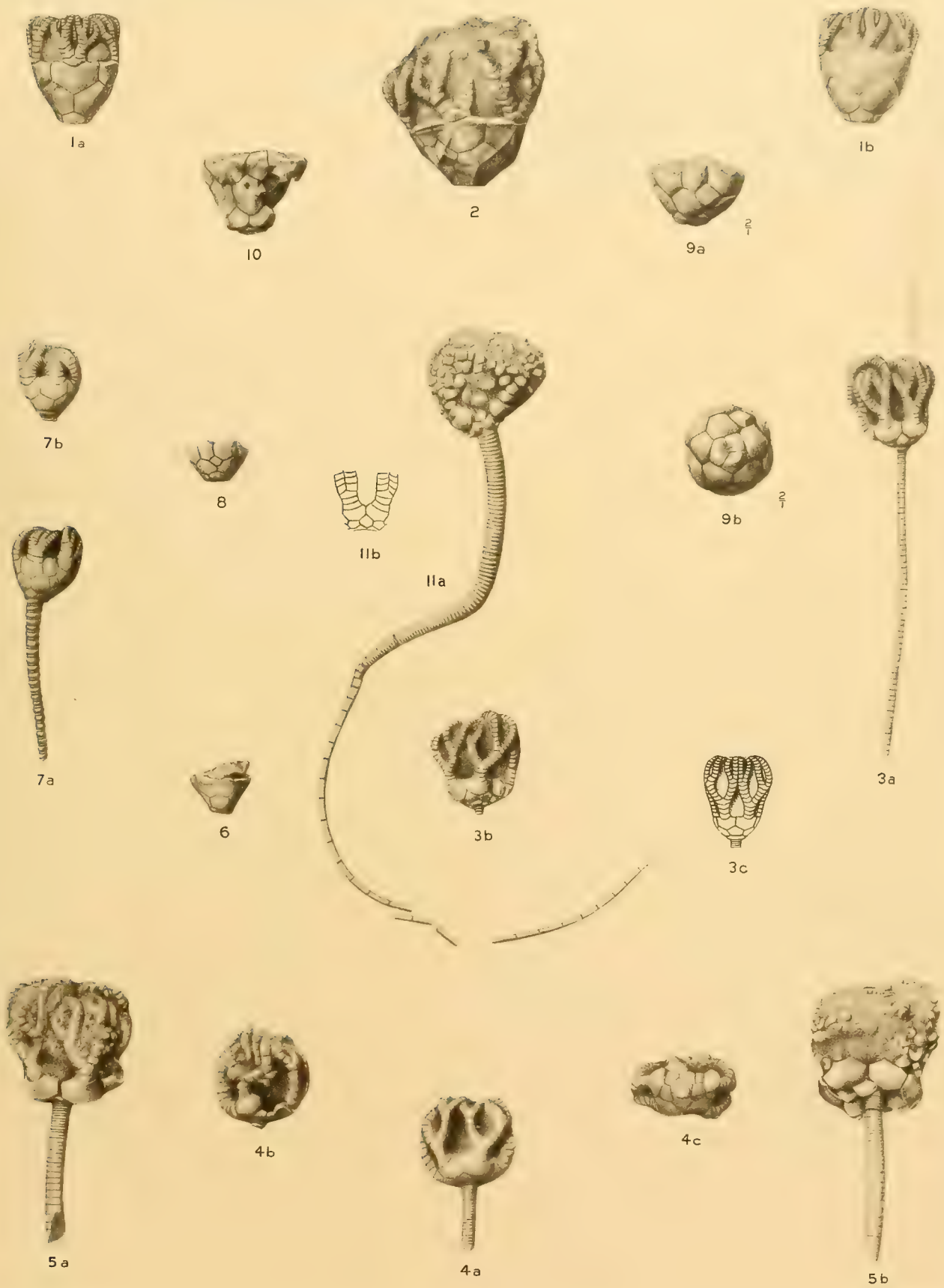

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PLATE XIV

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Figs. 1-5. **Hormocrinus tennesseesis** (Worthen) 167

FIG. 1*a*. Specimen with complete crown in almost natural contour, from anterior radius.

1*b*. Posterior view of same; showing anal plate with sloping shoulders and truncate apex connecting with a second range of 3 plates, and iBr with similar plates following.

1*c*. Distal view of same, showing short, stout arms.

1*d*. Basal view of same, enlarged, showing the angular effect produced by the radial ridges branching to the basals. × 2.

2*a*. Another specimen somewhat flattened, from l. ant. radius; iBr plate broad, directly followed by perisome.

2*b*. Crown from same position, enlarged. Distal parts of coiled arms, and slight remnants of perisome visible in iBr areas. × 2.

2*c*. Right posterior view of same. Natural size.

3. The largest specimen, somewhat flattened, with stem and arms complete; anterior view. The calyx above IBB is tilted back and foreshortened; stem like a string of beads, and tapering to a fine point.

4. Smaller specimen with part of stem, having shorter proximal columnals; calyx tilted and foreshortened.

5. Still smaller specimen with stem; proximal columnals relatively shorter.

Niagaran, Brownsport; Silurian. Decaturville, Tennessee.

All the specimens are in the author's collection.

Figs. 6-7. **Hormocrinus anglicus** n. sp. 168

FIG. 6. Flattened specimen with arms and stem, from l. post. interradius; IBr nearly as large as RR. British Museum, No. E1426.

7. Lateral view of another specimen. Author's collection.

Wenlock Gr.; Silurian. Dudley, England.

Fig. 8. **Hormocrinus gotlandicus** n. sp. 169

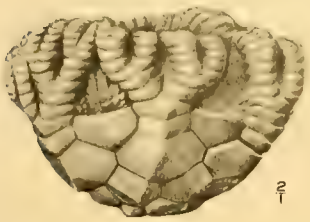
FIG. 8*a*. The type, in about natural contour seen from anterior radius. Has the arms nearly complete, and part of the stem; iBr probably directly followed by perisome; 3 IBr in ant. ray. × $\frac{3}{2}$. Riks Museum. Alskog (*f*).

8*b*. Same from left anterior ray with 5 IBr. × $\frac{3}{2}$.

8*c*. Posterior view, showing broadly truncate anal plate; 3 and 4 IBr in posterior rays. × $\frac{3}{2}$.

8*d*. Basal view of same. × $\frac{3}{2}$.

Wenlock Gr.; Silurian. Gotland, Sweden.



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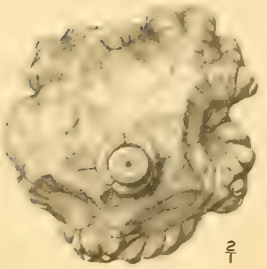

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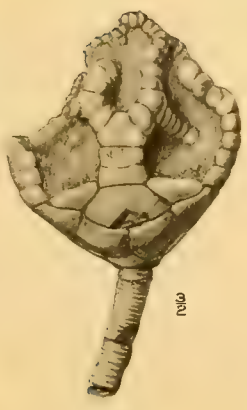

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Figs. 1-8. **Nipterocrinus wachsmuthi** Meek and Worthen..... 203

FIG. 1*a*. The type. Mature specimen with arms complete, calyx flattened and vertically crushed; 3 IBr and 8 or 9 IIBr. Mus. Comp. Zool., Harvard.

1*b*. Restoration of same, showing natural contour and length of arms; perisome restored from fig. 3.

2*a*, *b*. Two views of a similar specimen, somewhat flattened.

3. Small crushed specimen, showing some of the perisomic integument between the rays.

4. Base of crushed specimen with IBB separated from BB; showing undivided infrabasal disk. × 2.

5. Specimen with nearly complete stem, showing a few radicular cirri.

6. Smaller crushed specimen with part of stem.

7. Crushed specimen, somewhat intermediate, with 6 IBr and 10 IIBr.

8. Large specimen from lower part of Keokuk limestone, perhaps of this species.

Upper Burlington limestone; Lower Carboniferous. Burlington, Iowa.

All specimens, except fig. 1, are in the author's collection.

Figs. 9-10. **Nipterocrinus arboreus** Worthen..... 203

FIG. 9. The type, showing 4 and 5 IBr, and imbricated arms. University of Illinois.

10*a*, *b*. Two views of very finely preserved crown, slightly flattened. It has the interbrachial perisome intact, and extending to the third bifurcation; 4 and 5 IBr; and imbricated arms. × 2. Author's collection.

10*c*. Interbrachial area at "x" on fig. 10*b*, showing detail of perisomic integument where it is partly broken away. × 3.

10*d*. Basal view of same specimen, showing undivided infrabasal disk. × 2.

Lower Burlington limestone; Lower Carboniferous. Burlington, Iowa.

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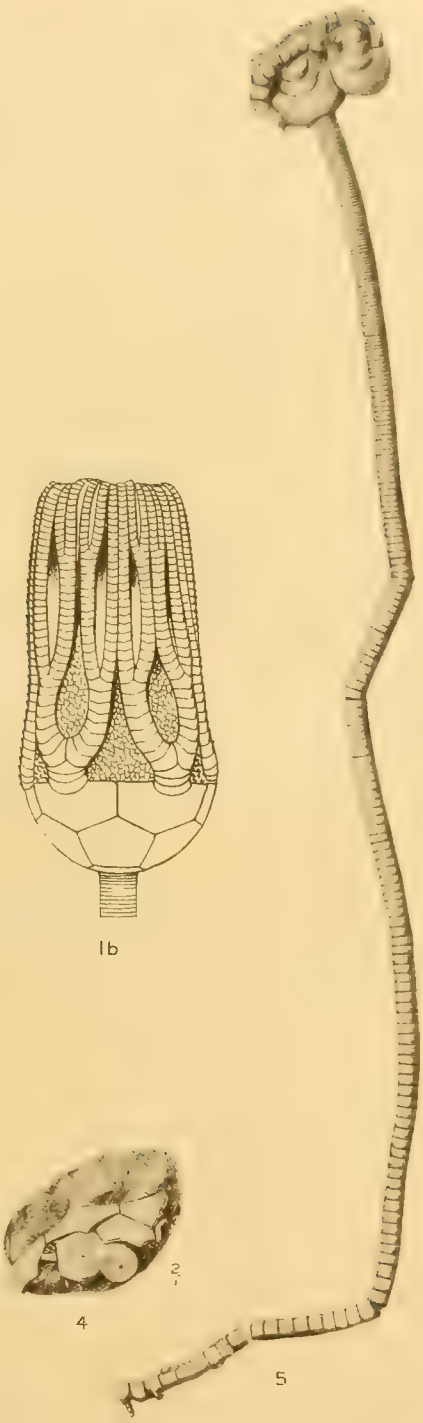

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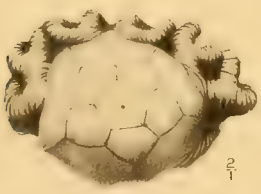

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PLATE XVI

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-15. **Temnocrinus tuberculatus** (Miller) 209

FIG. 1. The type: copied from Miller, Plate opp. p. 88, fig. 1. Enlarged.

2. Posterior view of large, flattened specimen. Shows plates of anal area suturally united to adjacent rays; also the characteristic surface ornamentation, and extra plate (RA) in r. post. ray.

3*a*. Another large specimen, but little compressed. Note the linear arrangement of tubercles on anal and iBr plates, and on upper Br, in this and the last specimen.

3*b*. IBr_2 and succeeding IIBr of same specimen enlarged, to show character of ornament and projecting nodes at the sides. × 2.

3*c*. A series of IIIBr and IVBr of same, showing the tubercles becoming confluent, forming vertical parallel ridges. × 2.

4. Specimen with large part of stem preserved, showing the tapering upper part with thin ossicles. Right posterior view of crown, showing RA in form of radial in median line of r. post. ray and connecting with radial to the right.

5. Left posterior view of small specimen, with finely plated perisome coming down from the tegmen between the rays, and connecting with iBr plates in lower part of areas. The anal structures, and full length of the arms coiled over the tegmen, are well shown. × 2.

6. Another specimen, posterior view, with perisome well preserved in anal interradius, and showing full size of radianal. Has a compound plate in l. post. ray.

7. Unflattened specimen, showing natural contour of crown; from r. ant. interradius.

8, 9, 10, 11, 12. Specimens more or less flattened, in different positions, showing radianal and various other characters of the species; fig. 12 is drawn with anal side to left.

13, 14. R. ant. and anterior views of well preserved specimens, the latter showing the coiled distal ends of the arm branches.

15. Mature specimen, in which the lateral nodes on brachials become very prominent; winged buttresses at lateral margins of rays; anterior view. British Museum.
Wenlock Gr.; Silurian. Dudley, England.

All the specimens are in the author's collection unless otherwise stated.

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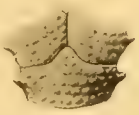

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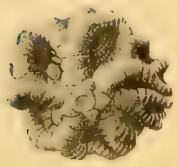

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PLATE XVII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-3. **Meristocrinus interbrachiatus** (Angelin)..... 212

FIGS. 1*a, b, c.* The type; original of Angelin, pl. 23, fig. 2*a*, and pl. 29, fig. 78. Right anterior, right posterior, and posterior views; the specimen is abnormal from injury and reparation. × $\frac{5}{3}$. Faro (d).

1*d*. Perisome from interradius opposite lower IIBr. × 3.

2*a*. A normal, somewhat flattened specimen from Wisby (*f*). Right anterior radial view, showing R + 3 IBr in the regular rays.

2*b, c*. Right posterior and posterior views of lower part of same; showing RA in form and position of a radial, the anal plate suturally connected, and the series following it. The r. post. ray has 4 IBr.

2*d*. Perisome opposite IIBr 1 and 2. × 3.

3*a, b*. Left anterior and posterior views of abnormal specimen from Faro.

3*c*. Perisome opposite IBr 2 and 3. × 3.

3*d*. Perisome in third axil. × 3.

Wenlock Gr.; Silurian. Gotland, Sweden.

All the specimens are in the Riks Museum, Stockholm.

Figs. 4, 5. (?) **Meristocrinus anceps** n. sp..... 214

FIG. 4*a*. Broken specimen from Wisby (*d*), with pentagonal RA, and anal plates passing quickly into perisome. × 2.

4*b*. Restoration of same. × 2.

5. Base of another specimen, posterior view. × 2.

Wenlock Gr.; Silurian. Gotland, Sweden.

Specimens in the Riks Museum, Stockholm.

Fig. 6. (?) **Meristocrinus tuberosus** n. sp..... 214

FIG. 6. A crushed specimen with rhombic RA, anal plate suturally connected, and large anal tube probably free beyond that. Probably a variant of *Gnorimocrinus*. × $\frac{3}{2}$. Riks Museum. Wenlock Gr.; Silurian. Wisby (*d*). Gotland, Sweden.

Fig. 7. **Meristocrinus orbignyi** (M'Coy)..... 213

FIG. 7. Copy of the type figure, which is somewhat restored, being made from a wax impression from a natural mould. Sedgwick Museum, Cambridge, England.

Upper Ludlow; Silurian. High Thorne, Kendal, Westmoreland County, England.

Figs. 8, 9. **Meristocrinus minor** n. sp..... 213

FIG. 8. Distorted specimen, showing 3 IBr; anterior view. British Museum, No. 6721.

9. Posterior view of another injured specimen found associated with last; showing RA, and faint indication of anal plates buried in the interradius. Author's collection.

Wenlock shales; Silurian. Dudley, England.

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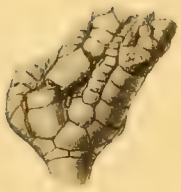
1d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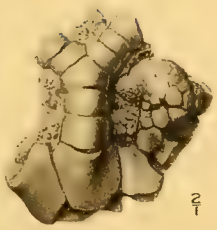
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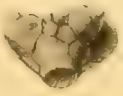
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PLATE XVIII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-9. **Sagenocrinus expansus** (Phillips) 218

FIG. 1. The type; copy of Phillips, Sil. Syst., pl. 17, fig. 9, reduced. From Dudley, England; formerly in collection of Benjamin H. Bright, near Dudley. It shows the interbrachial structure and arms very well. Whereabouts of specimen unknown.

2a. Large specimen, but little compressed, and having nearly the normal contour of mature calyx; posterior view. Shows 4 series of plates midway on the anal side. Dudley, England.

2b. Basal view of same; showing form and proportions of the principal calyx plates, especially RA within the ring of RR.

3. Similar rotund specimen, with arms nearly complete, posterior view; iBr passing into tegmen between IIIBr. Dudley, England.

4. Mature flattened specimen with arms complete and showing characters of stem; anterior view, base broken and distorted. Dudley, England.

5, 6. Two smaller flattened specimens in posterior views, showing position of RA. Dudley, England.

7. Smaller specimen with arms complete, anterior view; showing first iBr almost connecting with BB. Dudley, England.

8. Very young specimen, flattened, anterior view; iBr connecting with BB—a stage which suggested the reference by some authors to Rhodocrinidae. Dudley, England.

9. Very mature specimen, somewhat flattened, with plates marked by crescentic bands. Shows beautifully the full length of the coiled arms, and the iBr curving in upon the tegmen; lower part of calyx broken and restored in outline. Dudley, England.

Wenlock Gr.; Silurian. England and Gotland.

All the specimens are in the author's collection unless otherwise stated.

(Continued on Plate XIX)

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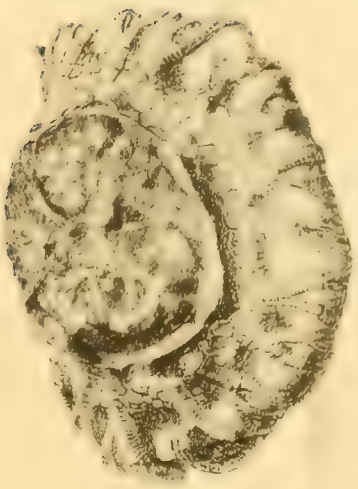

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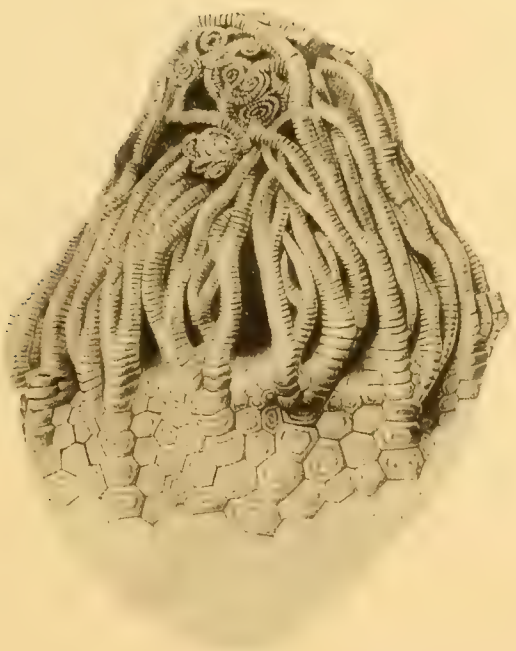

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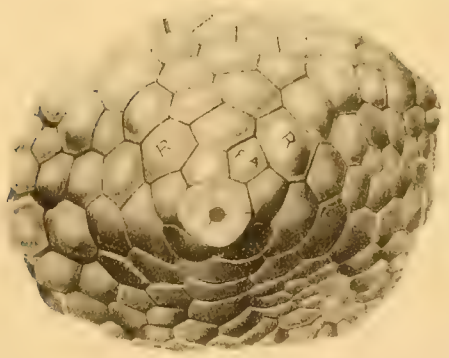

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PLATE XIX

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-3. **Sagenocrinus expansus** (Phillips), continued..... 218

FIG. 1*a*. Specimen from Gotland, almost rotund; original of Angelin, pl. 15, fig. 8, and pl. 27, figs. 8*a*, *b*, from left posterior interradius. Riks Museum. Follingbo (*f*).

1*b*. Anal side of same.

2. Flattened specimen from Gotland, from which Angelin's pl. 28, fig. 8, showing coils of the arms, was composed; l. post. view. Same collection.

3*a*. Slightly flattened specimen from Follingbo (*f*), Gotland, original of Angelin, pl. 15, fig. 6; l. post. interradial view. Same collection.

3*b*. Anal side of same.

3*c*. Left posterior ray of same. $\times \frac{3}{2}$.

Wenlock Gr.; Silurian. England, Gotland.

Fig. 4. **Sagenocrinus clarki** n. sp..... 220

FIG. 4*a*. Mature specimen much crushed, with arms and stem attached, left anterior view; showing the sharp median ridges along the brachial plates. Author's collection.

4*b*. Detail of part of anal side, showing form of RA.

4*c*. A IIBr, enlarged, showing form of median ridge. $\times 2$.

4*d*. Outline restoration of crown, showing actual contour of undistorted specimen.

Niagaran (Brownsport); Silurian. Decaturville, Tennessee.

Fig. 5. **Sagenocrinus americanus** Springer..... 221

FIG. 5. The type, posterior view. Shows the large BB, sinuous sutures, small arms, and RA above ring of BB. Author's collection.

Niagaran (Waldron shale); Silurian. Waldron, Indiana.

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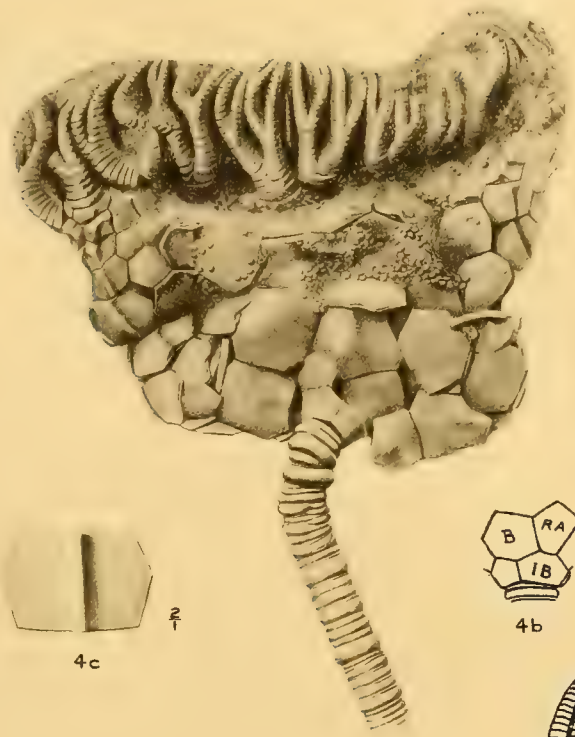

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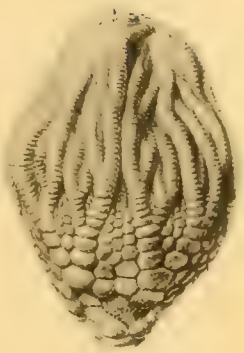

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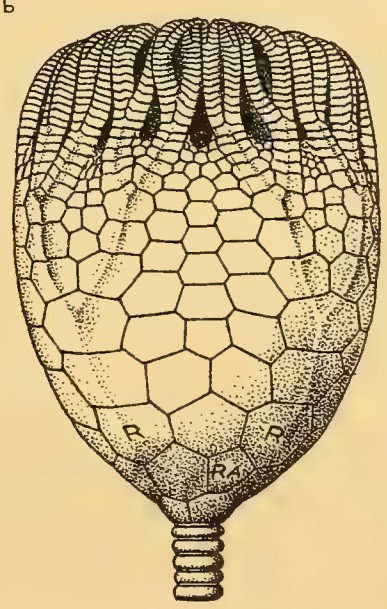

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PLATE XX

(All figures natural size except where otherwise stated)

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Figs. 1-3. **Lithocrinus divaricatus** (Angelin) 223

FIG. 1. The type: Original of Angelin, pl. 21, fig. 21; l. post. radial view. Shows plates of anal and regular interradii, and mode of arm division by branching ramules; stem is 25 mm. longer. $\times \frac{3}{2}$. Riks Museum. Wisby (*f*).

2a. Type of *L. robustus*, Angelin, pl. 21, figs. 11, 12. Flattened specimen; from anterior radius (abnormal, with only one IBr). $\times \frac{3}{2}$. Riks Museum. Wisby (*f*).

2b. Posterior view of same, showing three ranges of solid plates above the anal; l. post. ray broken. $\times \frac{3}{2}$.

3a. Crushed and broken specimen from Wisby (*f*). It is much larger than the type, and has the surface ornament and interbrachial structures well preserved; shows solid iBr plates isolated by perisome passing into the tegmen. $\times 2$. Riks Museum.

3b. Same specimen from the side, to show mode of arm branching. $\times \frac{3}{2}$.

3c. The ornamentation on a radial. $\times 3$.

Wenlock Gr.; Silurian. Gotland, Sweden.

Figs. 4-8. **Forbesiocrinus communis** Hall 245

FIG. 4. One of the types, Pal. Ohio, II, pl. 12, fig. 4. Anterior view of flattened specimen; showing the free rays, single iBr plate, and the stem, with expanded proximal part of thin columnals becoming alternating farther down, and longer. New York State Museum, Albany.

5a. Cotype, *ibid.*, fig. 5. Anterior view, showing first iBr plates, and coil of an arm to the end of terminal branch; not much flattened, contour nearly normal. Same collection.

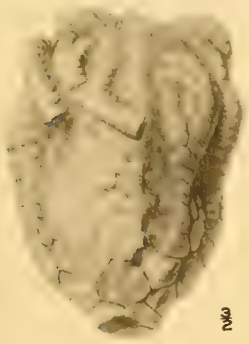
5b. Posterior view of same after additional cleaning. It shows structure of anal side; angular post. B., followed by anal suturally connected with rays, with one series adjoining r. post. ray up to the first IIBr.

6. Similar specimen, with anal series to the right extending to full height of IIBr, and the single iBr. Author's collection.

7, 8. Two other flattened specimens, showing anal structures and form and proportions of the rays. Author's collection.

Cuyahoga shales; base of Lower Carboniferous. Richfield, Ohio.

In none of these specimens is any of the perisome visible, although the spaces that must have been occupied by it above the anal and interbrachial plates are manifest.



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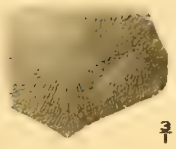

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PLATE XXI

PAGE

A series of diagrams to illustrate the structural differences between *Forbesiocrinus* and the leading Taxocrinoid genera; and the mode of union of plates at the lateral margin of the rays in both the regular and anal interradii. The same parts are represented in most of the diagrams, viz: the right posterior and right anterior rays, with the basal plates supporting them; and *a*, the marginal face of r. ant. ray; *b*, the marginal face of r. post. ray; *c*, the distal margin of iBr.

FIG. 1. **Forbesiocrinus nobilis.** Mountain limestone. Shows: (1) Form of post. B, with sutural distal face supporting anal plates articulated to adjacent rays. (2) Deep fossae around BB, and at the brachio-interbrachial sutures of r. ant. ray; with corrugated, straight, thick marginal surface above them, and at distal margin of iBr, for attachment of structure different from ordinary perisome. (3) Interbrachials with curved concave distal margin, not extending above IBr..... 249

2. **Forbesiocrinus agassizi.** Upper Burlington limestone. The same parts. Marginal faces of ray, angular for sutural attachment as high as upper IIIBr, and iBr extending in an apex to about the same height..... 250

3. **Forbesiocrinus saffordi.** Warsaw Gr. The same parts; showing thicker plates, and closer union at sutural faces..... 259

4. **Taxocrinus colletti.** Keokuk Gr. Shows: (1) Form of post. B, with plates of anal tube resting in socket below distal margin; (2)*a*. Margin of r. ant. ray, with sutural face for attachment of iBr up to IIBr 1 or 2, and smooth, rounded surface above for attachment of perisome. (3)*b*. Margin of r. post. ray from R up, next to anal area, with no sutural face, but smooth and rounded. (4)*c*. Distal face of iBr, similarly smooth and rounded. Note that these smooth margins entirely lack the straight corrugated surface seen in fig. 1..... 398

5. **Onychocrinus ulrichi.** Keokuk Gr. The same parts as in last figure; the sutural face for iBr extends higher up..... 425

6. **Parichthyocrinus subovatus.** Keokuk Gr. The same parts. Shows the same type of post. B, and anal area with smooth margins of adjacent rays, as in *Taxocrinus*, but with arms interlocking above iBr, giving sutural faces high up on rays next to regular interradii..... 415

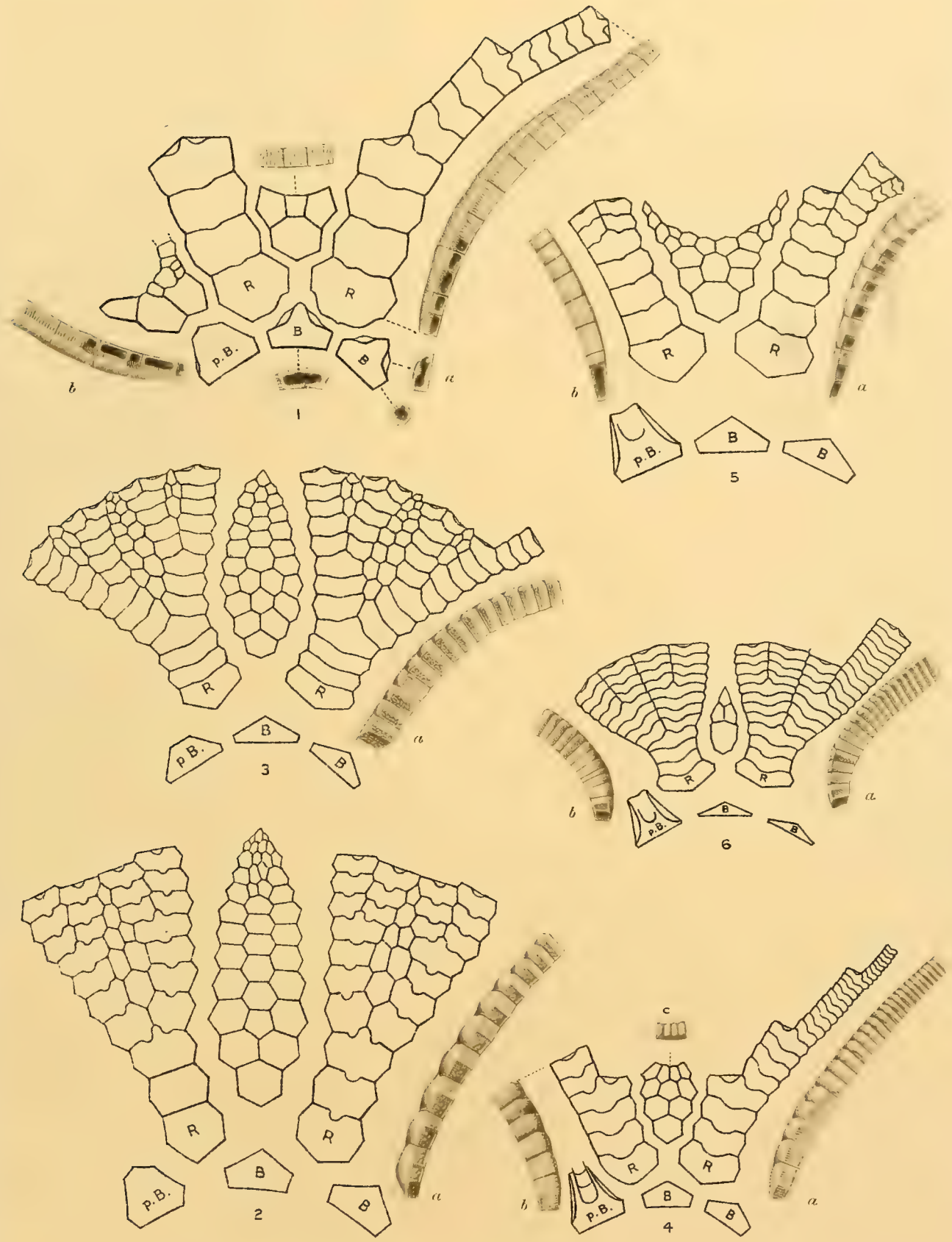

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PLATE XXII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-4. **Forbesiocrinus nobilis** De Koninck and Le Hon..... 249

(Also on Plates XXI, XXIII and XXIV)

FIG. 1*a*. The principal type specimen, on which the generic description and diagram were chiefly based; original of the author's fig. 2*b*. Copied, with some corrections of the anterior radius not properly shown in their figure, from De Koninck and Le Hon, Crin. Carb. Belg., pl. 2, fig. 2*b*. Anterior view; the specimen is much flattened, and the anterior ray mostly broken away; interbrachials to the height of the axillary IBr are seen to the left. Musée d'Histoire Naturelle, Brussels.

1*b*. Posterior view (not figured by De Koninck and Le Hon). Shows the angular posterior basal, with a few anal plates succeeding. The additional plates in the anal interradius shown by the generic diagram (fig. 2) cannot be identified in the specimen.

1*c*. Right posterior interradial view at the narrow compressed edge of the specimen, showing interbrachials, crowded together and pushed higher than their normal level.

1*d*. Left posterior interradius, with smaller number of interbrachials pushed by pressure into a vertical series.

2. Generic diagram of De Koninck and Le Hon (Recherch. Crin. Carb. Belg., 119).

3. Cotype, original of authors' fig. 2*a;* after De Koninck and Le Hon. This specimen in the Muséum d'Histoiré Naturelle, Paris, could not be located until after this plate was prepared. When finally discovered, through the kind offices of Professor Boule, it was found not to present any further definite structural details than are shown by the original figure, which I had already copied.

4. Fragment of IBr of smaller specimen, with somewhat finer surface marking. Author's collection.

Lower Carboniferous, Tournai Stage. Tournai, Belgium.

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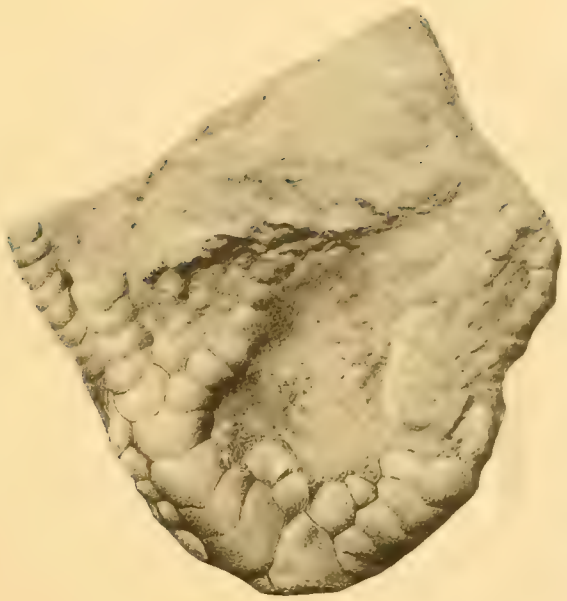

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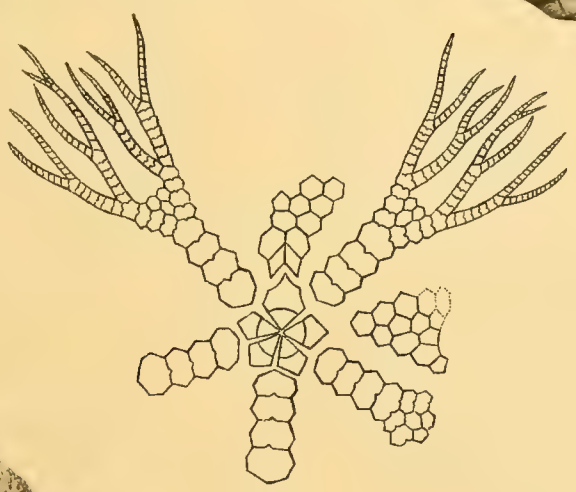

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PLATE XXIII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-8, 10. **Forbesiocrinus nobilis** De K. and Le H. (continued) 249

(Also on Plates XXI, XXII and XXIV)

FIG. 1*a*. A large, somewhat flattened specimen, in excellent preservation; from right posterior radius. It shows the surface ornament; the curved and corrugated distal margin of iBr plates continuous with the upper lateral face of IBr_2 and following brachials; the plates of the anal interradius, some to the right slightly disturbed, and perhaps the base of a tube-like series tending to the right. The distal brachial divisions in the right ramus of r. post. ray are irregular, indicating injury and reparation.

1*b*. Anterior view of calyx of same, to IBr_1.

1*c*. Right anterior ray of same, detached above IBr_1, ventral view. Shows the corrugated lateral face of the brachials from IBr_2—on which deep fossae are seen at the lower angular face—to $IIIBr_5$, where it has thinned and about disappeared; also the broad, shallow ventral concavity of the lower brachials, gradually passing into a median depression flanked by more or less parallel grooves connecting irregularly with the rugae of the margin. At the left an iIIBr is in place, with similar corrugated distal margin. × 2.

1*d*. Left lateral view of same (being the same edge exposed in fig. 1*a*); showing the structure of the lateral face of brachials more plainly. × 2.

1*e*. Distal portion of an arm, showing the great proportionate depth of the higher brachials.

2. Another large, much flattened specimen, seen from right posterior radius. It shows the same parts as fig. 1, with addition of proximal portion of stem, but the arm divisions are here normal. The plates seen beyond the second range in the right posterior interradius are not interbrachials, but are displaced brachials from some of the broken rays partly exposed in the matrix.

3. Stem of another specimen with IBB and two BB attached; showing sutural fossae at distal margin of post. B.

4. Diagram of base, composed from figs. 1 and 3; showing IBB, and axial opening in stem.

5. Diagram showing plates of anal side, from figs. 1 and 2; anal and following plates shaded in diagonal lines.

6. An axillary IBr, showing surface markings. × 2.

7. Ventral view of similar plate; showing lateral margins corrugated for attachment of perisome. × 2.

8. Similar view of another plate with sutural fossae part way up; showing that solid interbrachials sometimes extended higher up than is indicated in the two principal specimens, figs. 1 and 2.

9. A plate with margins entirely occupied by fossae, showing connection of solid iBr sometimes as high as the top of the axillary IBr. This specimen, of a species not described, is from Fern Glen, Missouri.

10. Proximal face of a radial. × 2 (enlargement fraction omitted on plate).

Lower Carboniferous, Tournai Stage. Tournai, Belgium (except fig. 9).

Figs. 11-13. **Forbesiocrinus** sp. 248

FIG. 11*a*. Part of a ray reconstructed from isolated R and IBr plates, dorsal view; showing angular sutural faces on R and IBr_1 and $_2$, for connection with solid interbrachials; and straight face of IBr_3.

11*b*. Lateral margin of same; showing sutural faces with large fossae on R and IBr_1 and $_2$, and corrugated faces for attachment of perisome on upper half of IBr_2, and on IBr_3.

12. Distal face of a radial. × 2.

13. Proximal face of first primibrach. × 2.

New Providence beds (Knobstone); Lower Carboniferous. Button Mould Knob, Kentucky, and Clark County, Indiana.

All specimens figured on this plate are in the author's collection.

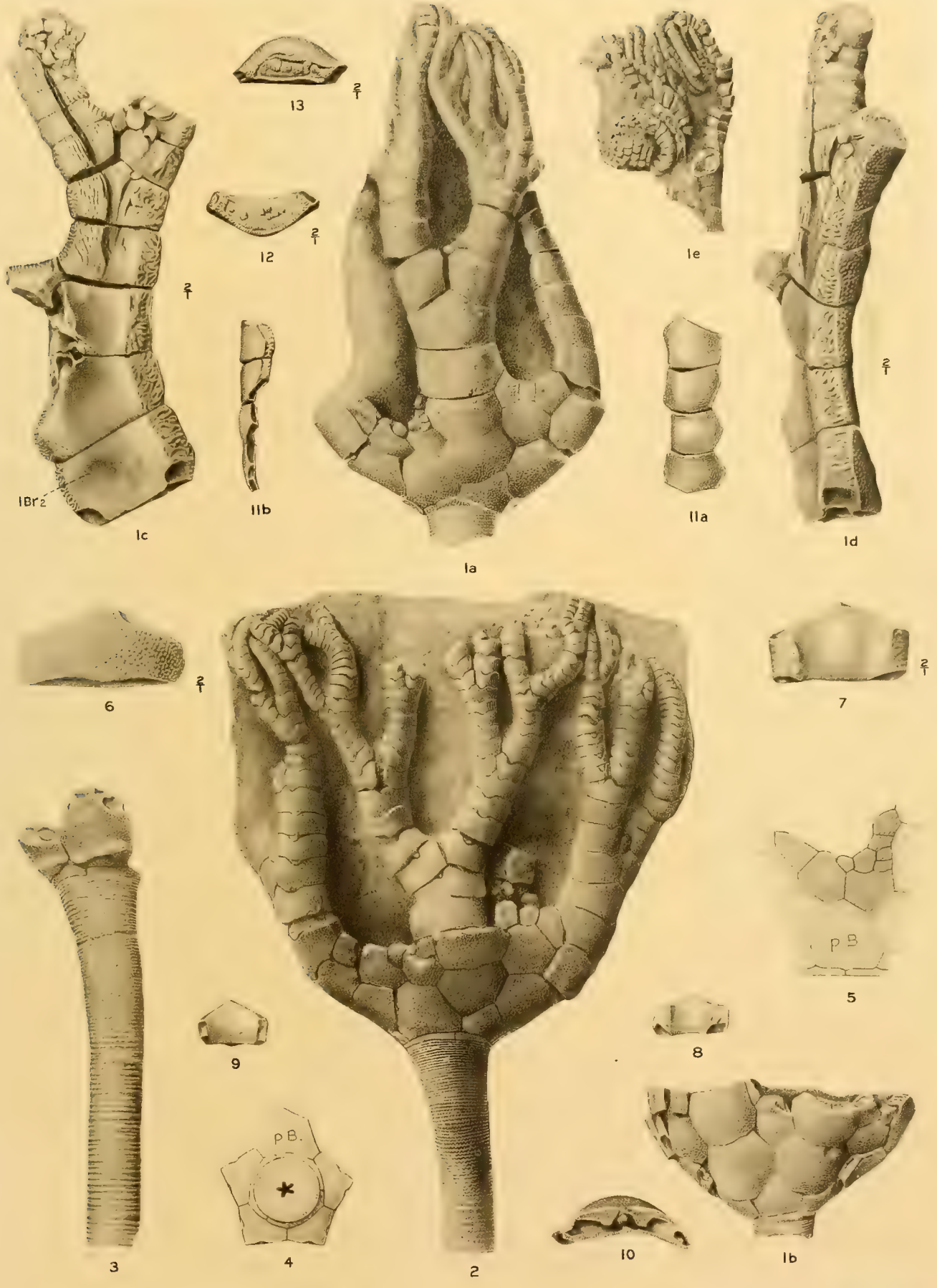

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PLATE XXIV

PAGE

Figs. 1-27. **Forbesiocrinus nobilis** De K. and Le H. (continued) 249

(Also on Plates XXI, XXII and XXIII)

A series of specimens showing the form and mode of articulation of the principal calyx and arm plates. In general the arrangement of the figures is in the natural order, i. e. basal plates below and brachials of successive ranges in ascending order. Being mostly detached and weathered plates, and not all from the same individual, the size is not always proportionate to their relative positions. Note the deep fossae in the apposed lateral faces of all the calyx plates up to, but not including, IAx, and the change in mode of attachment from there up; also the marked thickening of the plates upward.

For convenience of reference, the proximal view is always drawn with the dorsal side up, and the ventral view the reverse. Lettering in small type above the figures will help to identify the respective plates and the view given:—thus $IBr_1.d$ means primibrach 1, distal view.

All figures are $\times 2$, unless otherwise indicated.

FIG. 1*a*. A regular basal, proximal view; showing articulation with infrabasals by broad, shallow fossae, with deeper ones at the lateral faces.

1*b*. Another proximal view of same, showing lateral structure more plainly.

2*a*. A similar basal, dorsal view; showing surface ornament, and sockets for patelloid processes of radials.

2*b*. Distal view of same plate, showing deep fossae at basi-radial sutures.

3. Similar basal; direct view of upper sloping basi-radial suture.

4. Posterior basal, distal view; showing articulation with plates of anal interradius.

5*a*. First regular interbrachial, proximal view; showing lower lateral faces of union with radials.

5*b*. Distal view of same; faces of attachment by deep fossae to three interbrachials of second range.

6. Middle interbrachial plate of second range, distal face; showing entire change in mode of union with succeeding plates. Instead of fossae, as on the proximal face of this plate, there are rugose ridges extending the full thickness of the plate, probably for attachment of thick plated perisome; a fossa is seen at the lateral face for union with fellow interbrachials of the same range.

7*a*. A radial, proximal view; showing articulation with basals, and also the fossae at the brachio-interbrachial sutures. Thickness of plate less than one-third of the width.

7*b*. Distal view of same; fossa at lateral face meeting first interbrachial.

7*c*. Left lateral view of same; showing fossae and marginal crenulations.

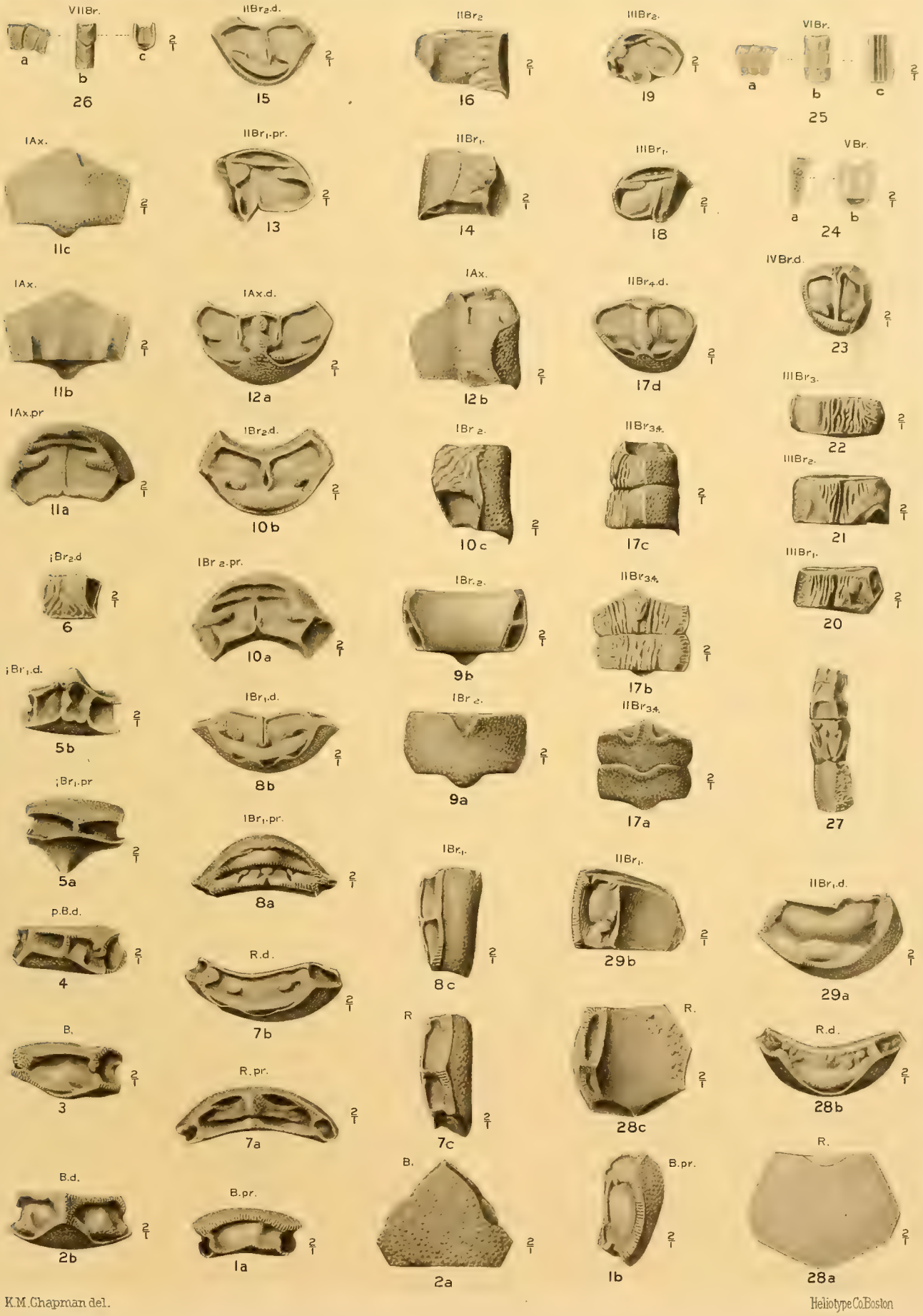
8*a, b, c*. Primibrach 1; proximal, distal, and left lateral views. Note the three different modes of union at the faces of this plate, viz.: by deep fossae at the sides (with iBr); by bundles of ligament at the face meeting R; by paired ligamentous articulation at the face meeting the succeeding IBr.

9*a, b*. Primibrach 2; dorsal and ventral views. The former shows the indentation and projection for the patelloid processes, and the latter the broad, smooth inner surface, without any appearance of median grooves. On this plate the lateral connection by fossae extends nearly to its full height.

10*a, b, c*. Primibrach 2. Proximal, distal, and left lateral views of another specimen, in which the change in mode of connection with interbrachials from deep fossae to rugose ridges and furrows occurs about halfway up the plate. On the radial faces the elements of a modified articulation by paired ligaments are sharply defined, viz.: dorsal ligament fossae; transverse ridge; interarticular ligament fossae; median ridge with a groove along its middle. The median sinus is strongly marked with a rather deep cavity, which continues more or less defined throughout the ray—perhaps a remnant of perforation by a dorsal canal.

11*a, b, c*. Axillary Primibrach 3 = IAx. Proximal, ventral, and dorsal views; showing radial articulation, the patelloid processes, and the sockets in which they engage.

12*a, b*. Axillary primibrach 3 = IAx. Distal and left lateral views of another specimen. The lateral fossae are no longer seen, but the rounded rugose ridges with furrows which seem to discharge, and sometimes to converge, toward the interior, are finely shown in this and the next following figures, 14 and 16. These plates are nearly half as thick as wide.



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Figs. 1-27. **Forbesiocrinus nobilis** De K. and Le H. (continued)..... 249

FIG. 13. Secundibrach 1, proximal articulating face. The left side is truncated to meet its fellow above the axillary.

14. Right lateral face of another specimen of same rank.

15. Secundibrach 2, distal articulating face.

16. Left lateral face of another plate of same rank.

17*a, b, c, d.* Secundibrachs 3 and 4; dorsal, ventral, left lateral, and distal faces. The ventral surface is no longer concave, and has become marked by more or less distinct longitudinal ridges and grooves for the attachment of perisome, with which the transverse lateral grooves seem at times irregularly to connect (shown also in figs. 20-22). The rugose margin has become proportionally narrower, and the thickness of the plates has increased to two-thirds their width.

18, 19. Tertibrachs 1 and 2, proximal articulating faces.

20, 21, 22. Ventral surface of tertibrachs 1, 2 and 3; showing the varying appearance of the longitudinal grooves, and the rugosity upon the lateral face; this has become narrower and is gradually disappearing.

23. Quartibrach, distal face. The plates have now become as thick as wide, and the lateral rugosity has disappeared.

24*a, b.* Brachials of fifth order; lateral and distal views.

25*a, b, c.* Brachials of sixth order; lateral, dorsal, and ventral views.

26*a, b, c.* Brachials of seventh order; lateral, dorsal, and distal views.

The last three series of plates are dissected from the incurved arms of the specimen figured on Plate XXIII, figs. 1*a*, and 1*e*, and their position is authentic. The brachials have here become relatively very thick and narrow, with a well defined median longitudinal groove on the ventral side flanked by another one on either side. From what is observed in the corresponding parts of *Synerocrinus incurvus* (Pl. XLII, fig. 5*b*), it is clear that these grooves and the partition between them formed the lodgement for small plates of a perisomic integument, which may have taken the form of ambulacra over the median groove at this stage. They are enclosed by strong projections at the margins of the plates, producing a concave ventral surface, in contrast to the flatness, or even convexity, in the intermediate radial divisions.

27. Lateral face of brachials in a fragment of an abnormal ray from specimen figured 1*a*, Pl. XXIII, showing a radial articulation, with rugose lateral face above and below it. Natural size.

All the specimens are from the Tournai Stage, Lower Carboniferous; Tournai, Belgium; and are in the author's collection.

Figs. 28, 29. **Forbesiocrinus** sp..... 248

FIGS. 28*a, b, c.* A radial. Dorsal, distal, and lateral views of an isolated plate found in strata equivalent to the Kinderhook-Lower Burlington, at Lake Valley, New Mexico. It has the same deep lateral fossae seen in the Belgian specimens. Author's collection.

29*a, b.* Secundibrach 1, from same locality. Distal and inner lateral faces, the latter being the sutural union with its companion plate above the axillary. Author's collection.

PLATE XXV

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-6. **Forbesiocrinus agassizi** Hall..... 250

(Also on Plates XXI, XXVI)

FIG. 1. The type, anterior view. Now in the Hall Collection, University of Chicago.

2. A very large specimen, slightly flattened, with the normal number of 3 IIBr. Posterior view, showing plates of the anal interradius, filled with solid plates to the height of IIIBr 2 or 3, in perfect sutural connection with the plates of adjacent rays; and the sinuate sutures, with patelloid processes, throughout the rays. Author's collection.

3*a*. Flattened specimen with calyx plate somewhat displaced, anterior view. Shows characteristic gibbosity of plates. Author's collection.

3*b*. Left posterior view of same, showing sutural connection of post. B with succeeding plates.

3*c*. Detail of left anterior ray, showing sutural faces of R and IBr_1. × 2.

4. A large specimen of the type of var. *giganteus* M. and W., with 4 IIBr in three rays, and 3 IIBr in the others; somewhat flattened; left anterior view. Shows the extremely sinuate sutures throughout rays and arms, and patelloid projections on proximal face of separated brachials; also how the interbrachial plates run to an apex high up between the rays. Author's collection.

5*a*-6*g*. A series of specimens showing the markings upon the articulating and sutural faces of various plates. All in author's collection.

5*a*. Basal and radial plates from a single disintegrated specimen, dorsal view; used in the next following figures.

5*b*. Proximal face of basal. × 2.

5*c*. Distal sloping face of basal at basi-radial suture. × 2.

5*d*. Proximal faces of radial. × 2.

5*e*. Distal face of same. × 2.

5*f*. Lateral face of radial. × 2.

6*a*-6*g*. Plates from another specimen. All × 2.

6*a*, *b*. Proximal and distal faces of axillary $IBr_2 = IAx$.

6*c*, *d*. Proximal and distal faces of IIBr.

6*e*. Left lateral face of same.

6*f*. Lateral face of interbrachial iBr.

6*g*. Dorsal view of same.

Upper Burlington limestone; Lower Carboniferous. Burlington, Iowa; Washington County, Indiana.

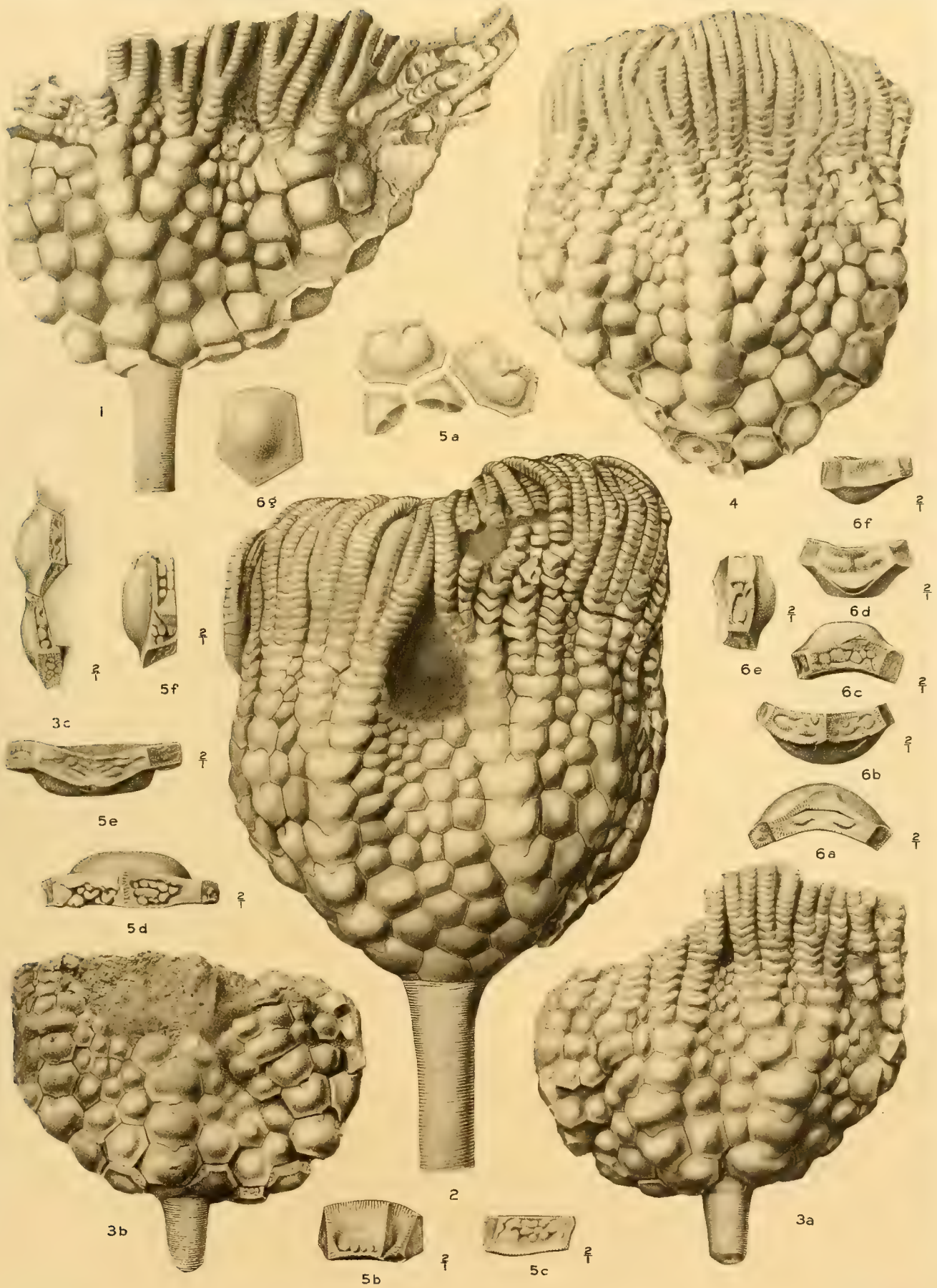

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PLATE XXVI

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-2. **Forbesiocrinus agassizi** Hall (continued) 250

(Also on Plates XXI, XXV)

FIG. 1*a*. Lateral view of large, flattened specimen, showing nearly full length of arms.

1*b*. Dorsal view of IBr, showing form of patelloid process and socket of proximal and distal ends respectively. × ¾.

1*c*. Axillary IBr, dorsal view; showing same structures. × 2.

2*a*. Proximal end of stem with IBB fused to top joint the full width of column exteriorly, but sloping to a small pentagon at the interior.

2*b*. Ventral view of IBB in same specimen, showing impression of BB and relative size of IBB pentagon at the interior.

2*c*. Interior of IBB enlarged, showing form and position of channels passing down into column. By oversight the suture between the two large IBB is drawn bisecting the septum, whereas it coincides with the angle of the large channel just above. This funnel is irregular in the apparent position of the small IB, which is probably a greatly reduced compound plate, while the simple infrabasal should be the one at the top of the figure, here enlarged to include the whole of the uncompressed lobe to the right instead of only half of it. × 4.

2*d*. Cross-section of base, showing flat position of IBB; composed from this and other specimens.

Upper Burlington limestone. Burlington, Iowa.

All the specimens are in author's collection.

Figs. 3-5. **Forbesiocrinus burlingtonensis** n. sp. 253

FIG. 3*a*. Mature specimen vertically compressed, showing three IBr; posterior view. Author's collection.

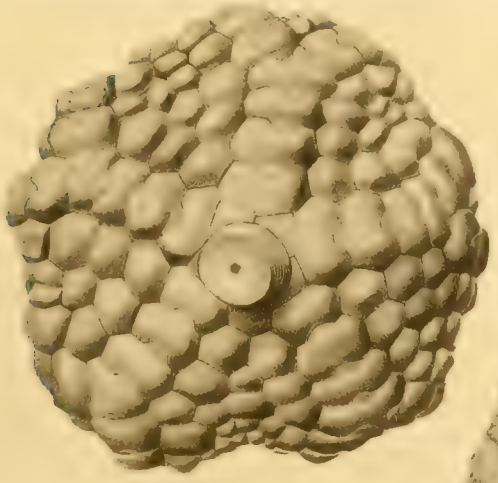
3*b*. Basal view of same, drawn with anal side down. Author's collection.

3*c*. Distal view of same, showing infolded arms.

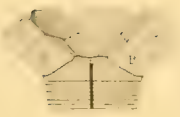
4. Anterior view of specimen but little flattened, showing extremely sinuous sutures and gibbous plates. Mus. Comp. Zool.

5. Posterior view of similar specimen, showing tendency of anal plates to form a vertical series at the right (the apparent bifurcation shown in the drawing is misleading). The patelloid projections here occupy over half the width of the plates and strongly modify the form of the median elevation. Author's collection.

Upper Burlington limestone. Burlington, Iowa.



3b



2d

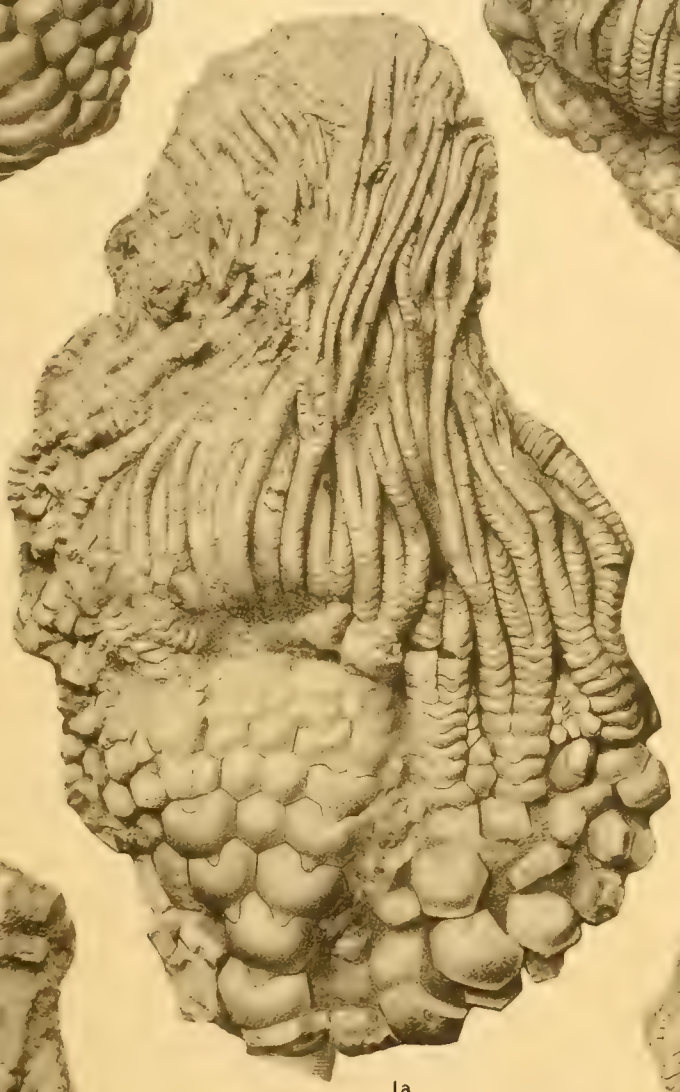
3c

2a

2b

2c

4/1



1a

1Ax.

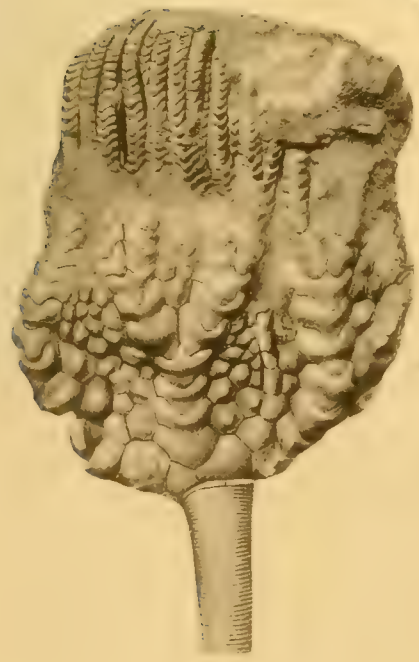
2/1

1c

1Br.

3/2

1b



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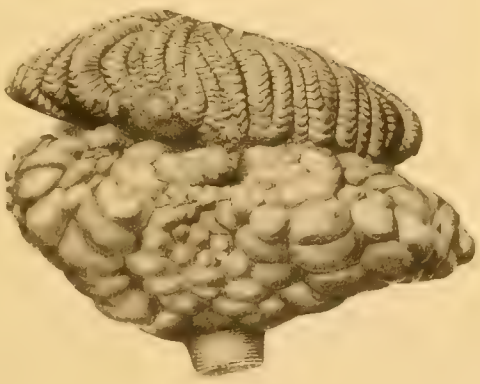

3a

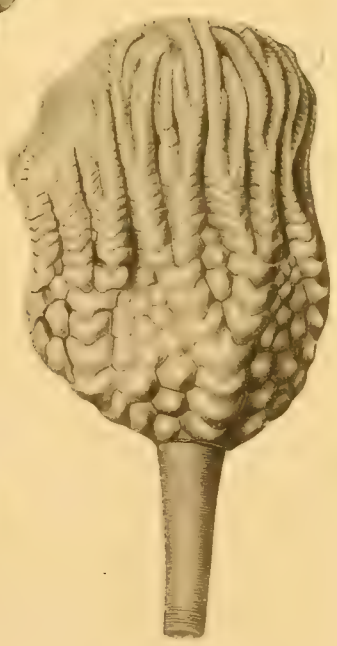

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PLATE XXVII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-8. **Forbesiocrinus wortheni** Hall..... 253

FIG. 1. The type, dorsal view; drawn after additional preparation exposing outline of basal plates not shown in original figure; infrabasals broken away and axial opening obscured by matrix. The specimen is vertically compressed, and shows the broad, flat rays and abundant interbrachials of the species. It is a very mature individual, with maximum development of interbrachials. University of Illinois.

2. Similar view of another specimen with a few proximal stem joints attached, and showing tendency of anal plates to form a median series. Author's collection.

3. Mature specimen, laterally compressed; showing stem beyond the enlargement, and arms infolding beyond fifth division; anterior view. Author's collection.

4. Less mature specimen, vertically compressed; dorso-anterior view. Author's collection.

5. Posterior view of similar specimen, showing anal plates. Author's collection.

6. Specimen from Nauvoo, Illinois; right posterior view. Author's collection.

7. Young specimen from Niota, Illinois; left posterior view. Author's collection.

8. Mature specimen from Jersey County, Illinois; posterior view; showing profuse development of interbrachials. Type of *Forbesiocrinus macadamsi* Miller and Gurley. Their figure in Bull. 9, Ill. St. Mus., Pl. V, fig. 1, is not correct as to the basal plates. University of Chicago.

Keokuk limestone; Lower Carboniferous. Keokuk, Iowa, and various localities on Mississippi River.

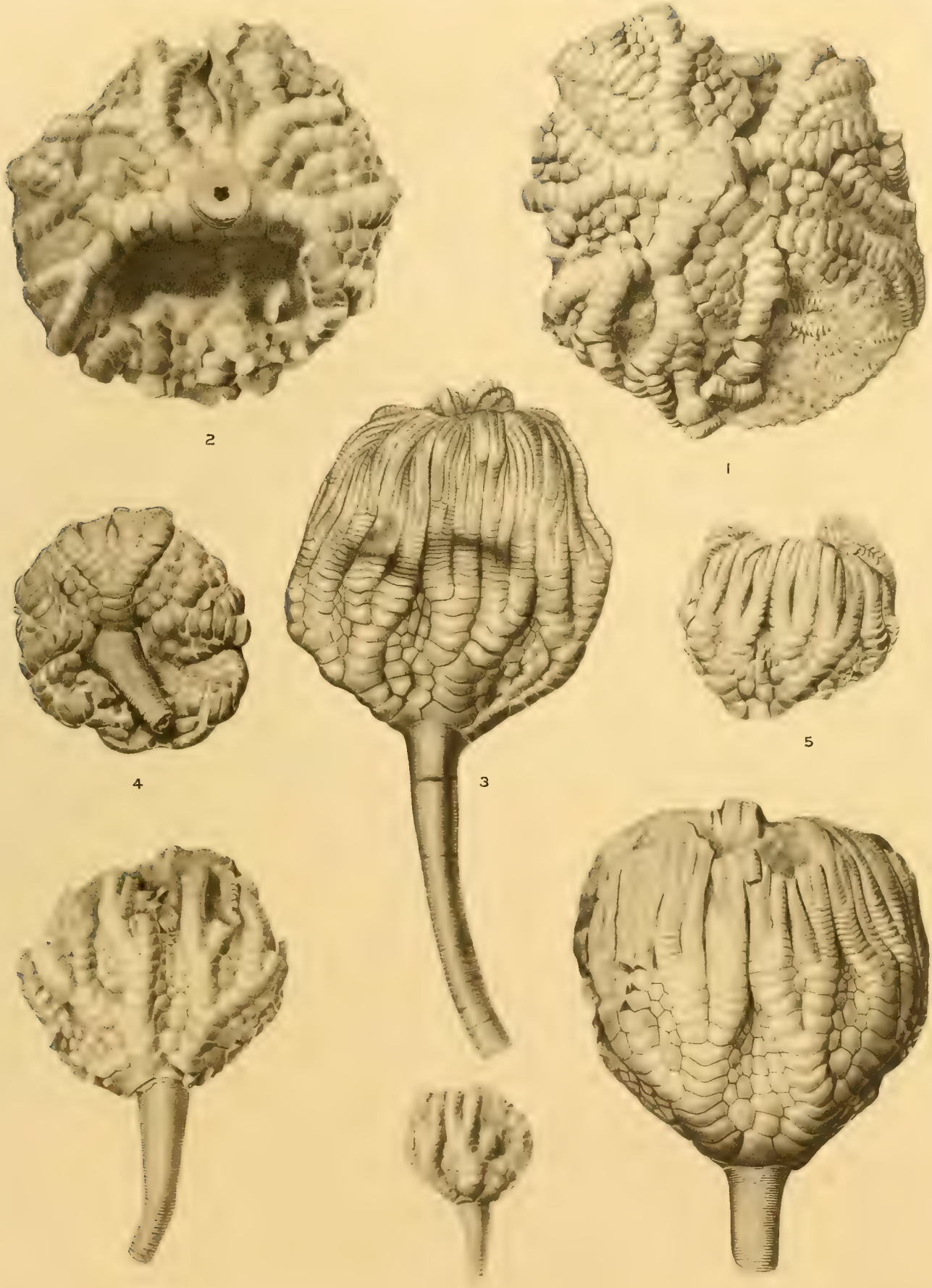

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PLATE XXVIII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-19. **Forbesiocrinus multibrachiatus** Lyon and Casseday..... 255

(Also on Pl. XXIX)

FIG. 1*a*. The type, laterally compressed; anterior view. The specimen is somewhat weathered, which along with the compressed condition gives the arms a flatter appearance than is seen in numerous well-preserved specimens from the same locality. Author's collection.

1*b*. Posterior view of same. The compression has forced the left posterior ray partly over the anal plates, so that some of them are not seen.

2. Very mature specimen, laterally compressed, posterior view; with stem very well preserved, and arms to the fifth division. Shows anal and interbrachial plates, and the rounded character of the arms.

3. Posterior view of a similar, but smaller, specimen; the crown is less flattened, but the stem is flattened distally, so that the normal taper is not preserved.

4, 5, 6. Similar flattened specimens with profuse development of anal and interbrachial plates; showing tendency to form vertical series up the middle of anal area. Of the type figured by Meek and Worthen as *F. wortheni,* Geol. Rep. Ill., pl. 4, fig. 2; 12, fig. 7.

7*a*, 8*a*, 9, 10. Smaller specimens in various positions, showing diminishing number of interbrachials.

7*b*, 8*b*. Anal areas of corresponding specimens.

11, 12, 13, 14. Smaller specimens in different views, showing still further diminution in number of interbrachials.

14*a*. Anal area of 14.

15*a*, 16, 17, 18*a*. Still younger individuals, with interbrachials reduced to very few.

15*b*, 16*a*. Anal areas of the corresponding specimens; 15*b*, × 2.

18*b*. Posterior view, enlarged, of specimen figured at 18*a*, showing the sutural attachment of anal plates to posterior basal and adjacent brachials. × 2.

The above mentioned specimens from 2 to 18, all from the same locality and horizon, and belonging to a single colony, form an interesting series showing the development of the interbrachial system with growth of the individual, from very young like 14, 15, 16, with one to three plates, to mature forms like 2, with nineteen or twenty interbrachials.

19. Stem with IBB fused; drawn with small plate at right upper corner, instead of lower as usual.

Keokuk Gr.; Lower Carboniferous. Indian Creek, Indiana.

All the specimens are in the author's collection.

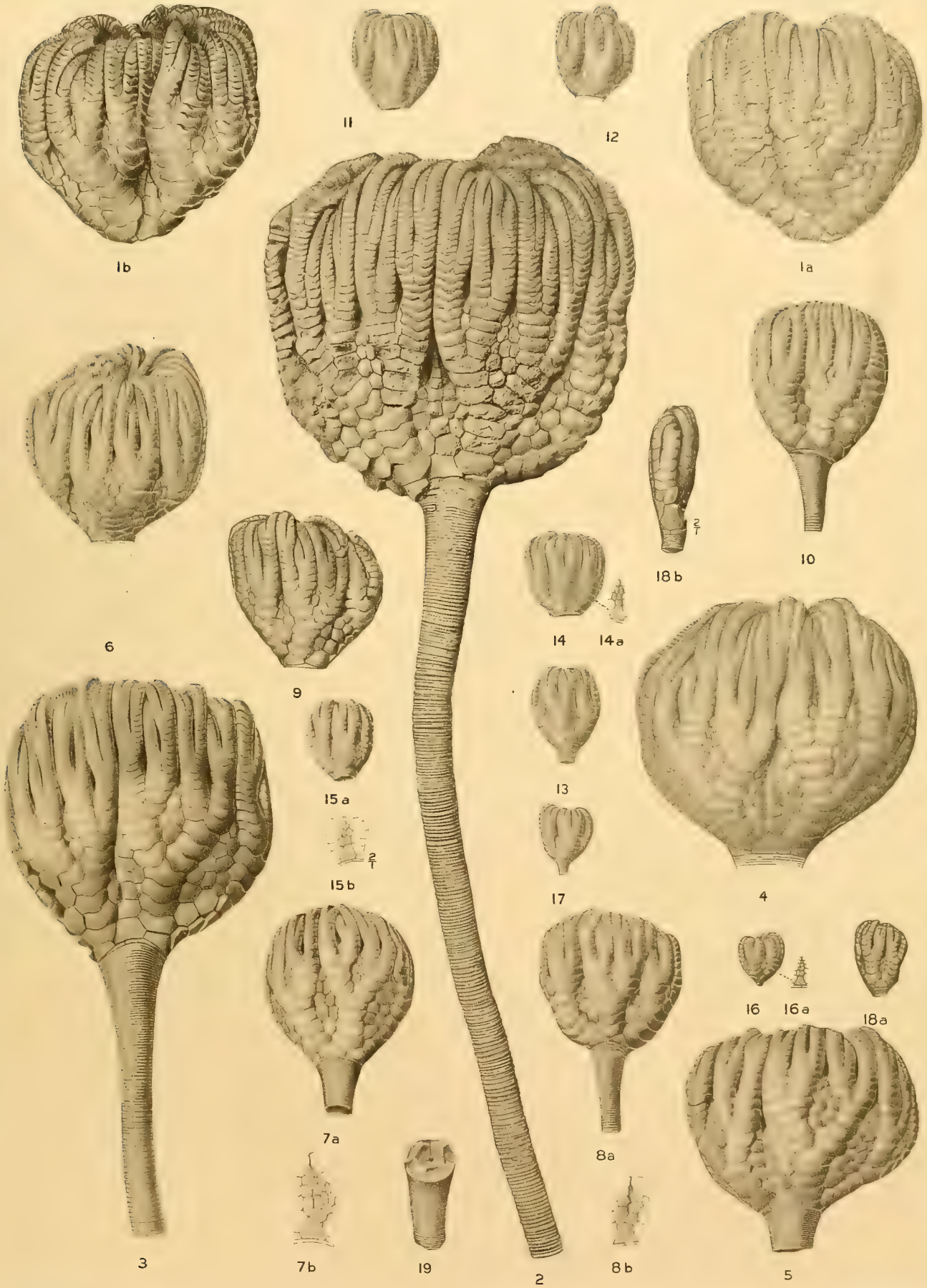

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PLATE XXIX

(All figures on this plate natural size)

PAGE

Figs. 1-3. **Forbesiocrinus washingtonensis** Miller and Gurley..... 256

FIG. 1*a*. One of the types, slightly compressed. Anterior view, showing the flat, closely abutting arms; the high level to which the interbrachials extend; and the general convexity of the plates. University of Chicago.

1*b*. Postero-basal view of same; the IBB have been pulled away with the column.

2. Posterior view of cotype. University of Chicago.

3*a*, *b*. Right anterior and posterior views of another somewhat flattened specimen, showing the characteristic proportions of arms, and the limit of calyx to upper level of interbrachials. Author's collection.

Keokuk Gr.; Lower Carboniferous. Washington County, Indiana.

Figs. 4, 5. **Forbesiocrinus multibrachiatus** Lyon and Casseday..... 255

(Also on Pl. XXVIII)

FIG. 4. A small specimen from same locality as last; right posterior view. Author's collection.

5. The type of Miller and Gurley's *F. speciosus*, from the same locality and horizon. Drawn after further cleaning, so as to show posterior basal and anal plates, not visible in the original figure. University of Chicago, No. 6267.

Keokuk Gr.; Lower Carboniferous. Washington County, Indiana.

Figs. 6, 7. **Forbesiocrinus pyriformis** Miller and Gurley..... 257

FIG. 6*a*. The type, from Muldraugh Hill, Kentucky. Anterior view, showing the pyriform crown and strongly rounded arms. University of Chicago.

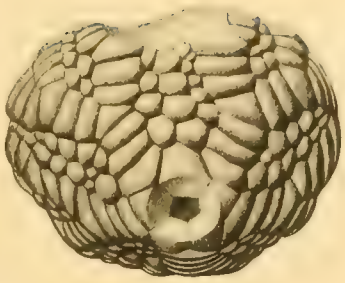
6*b*. Posterior view of same, showing anal plates.

7*a*. Anterior view of a very large specimen from White's Creek, Tennessee, slightly compressed dorso-ventrally. Shows the deeply rounded arms, and marked convexity of the plates generally. Author's collection.

7*b*. Left posterior basal view of same, showing anal plates at the right.

Keokuk Gr.; Lower Carboniferous.

6a

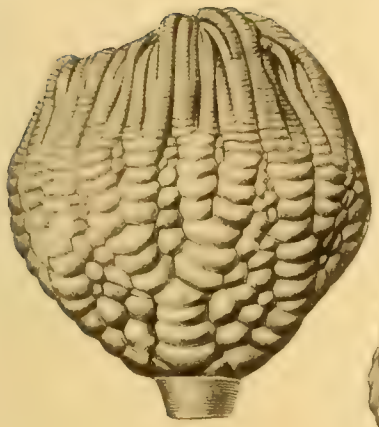


1b

6b

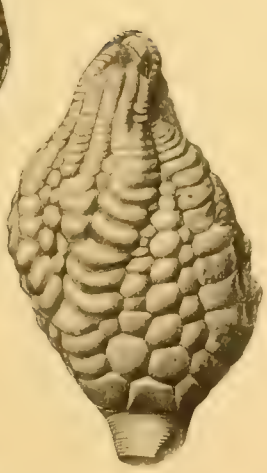
4

5



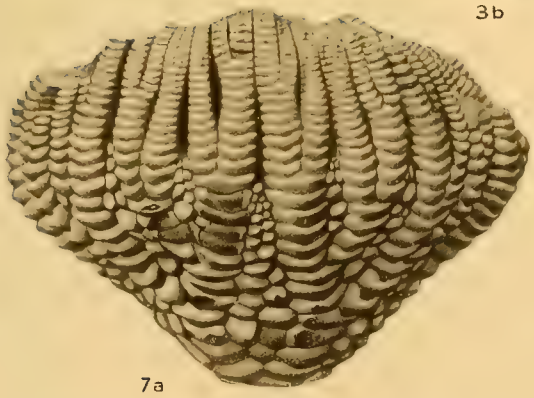
3a

1a

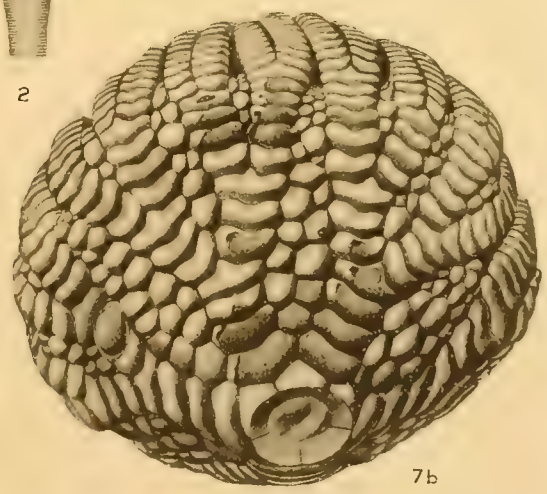


3b

2



7a



7b

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PLATE XXX

(All figures natural size except where otherwise stated)

PAGE

Figs. 1, 2. **Forbesiocrinus greenei** Miller and Gurley..... 258

FIG. 1. The type, posterior view. Shows the relative flatness of the plates, little depression of interbrachial areas, and their great vertical extent. University of Chicago.

2*a*. Another specimen from the same locality, from right posterior interradius; showing the rays to the third bifurcation, with iBr plates extending still higher up. Author's collection.

2*b*. Basal view of same. The IBB have been detached, having been fused with the top columnal.

Keokuk Gr.; Lower Carboniferous. Edwardsville, Indiana.

Figs. 3-17. **Forbesiocrinus saffordi** Hall..... 259

(Also on Plates XXI and XXXI)

A series of specimens to show the structures at the inner floor of the calyx, especially the form and course of the axial cords passing down into the column. Some are detached bases with one or more columnals in position, and some are proximal parts of stem with infrabasals fused to the top ossicle. Note that the small infrabasal, except in fig. 10, is at the anterior side instead of right posterior as usual in the group. The central part of the infrabasals is occupied by a large, tri-lobate funnel coinciding in position with them, and converging toward the axial opening; the channels in the radial lobe and one of the others each divide by a septum into two, producing with the third five channels downward into the stem, interradially disposed.

FIG. 3*a*. Calyx with RR attached, dorsal view, × 2; 3*b*, ventral view, × 2; 3*c*, interior of IBB, showing funnel, septa, and channels. × 4.

4*a*. Stem with fused IBB only, dorsal view, × 2; 4*b*, ventral view, × 2; BB mostly removed, showing full size of IBB, and how small a part of them is exposed at the interior.

5*a*. IBB and BB with very thin upper stem ossicle attached, and sutures of IBB appearing faintly through it, showing their size exteriorly equal to the column, dorsal view, × 2; 5*b*, ventral view, showing the much smaller part of IBB exposed at the inner floor, × 2; 5*c*, interior surface of IBB, × 4.

6*a*. IBB and BB with columnal, dorsal view, natural size; 6*b*, ventral view, natural; 6*c*, IBB, interior, × 4.

7*a*. Ventral view of calyx with RR attached, showing articulating faces, × 2; 7*b*, internal surface of IBB, × 4.

8, 9. Specimens showing calyx with RR, and top stem ossicle attached.

10. Calyx with RR, showing surface of articulation, and of union with iBr; ventral view, funnel but little preserved.

11. IBB only; funnel not preserved.

12, 13, 14. Distal view of stems at various distances from the calyx, showing forms of axial opening. × 2.

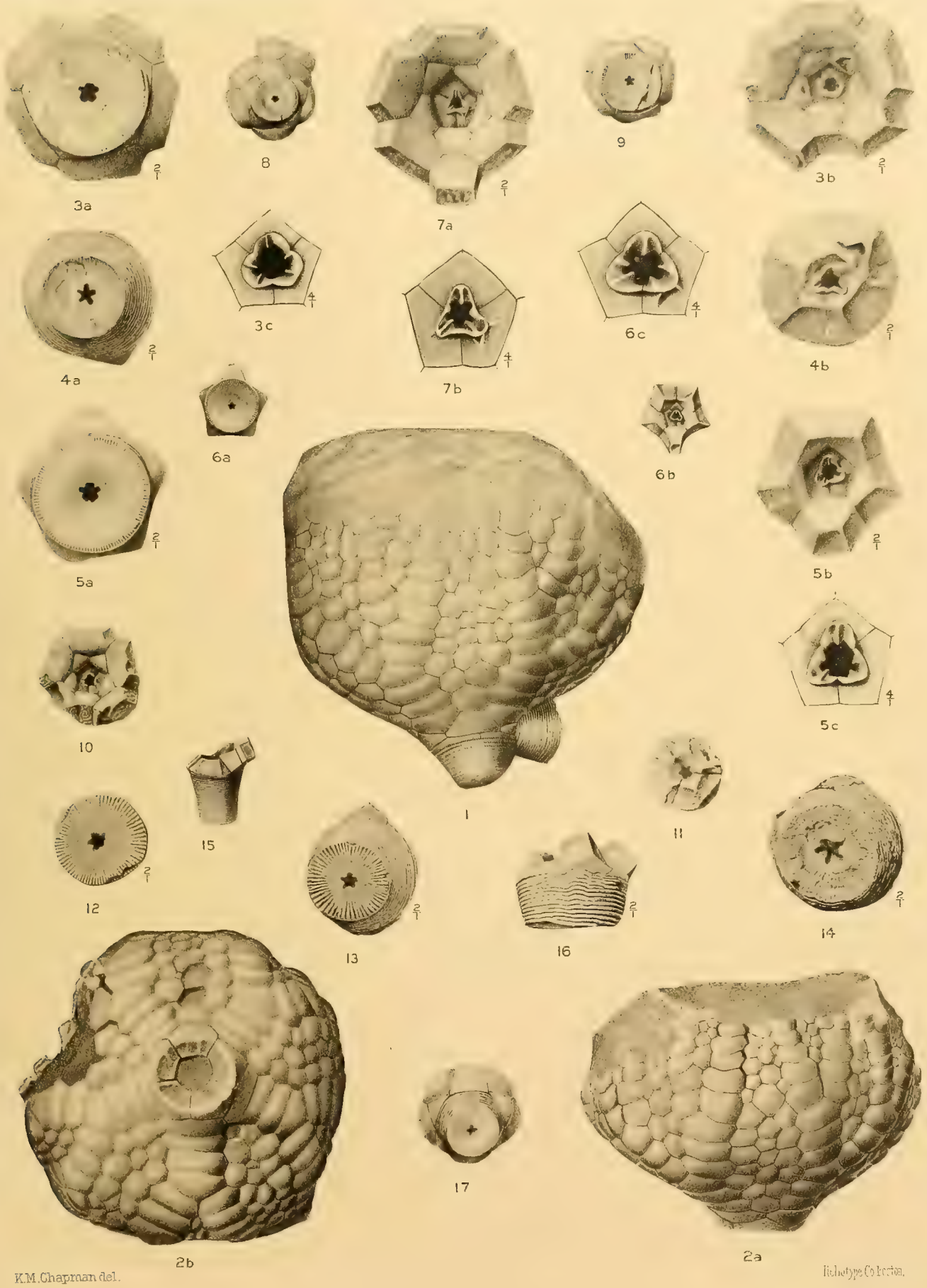
15. Proximal part of stem, with IBB fused to top ossicle, some BB attached; lateral view.

16. Proximal part of stem with IBB and some BB attached, showing extreme thinness of the columnals. × 2.

17. Specimen with post. B angular; from same locality, probably of another species; dorsal view.

Warsaw limestone; Lower Carboniferous. Spergen Hill, Indiana.

All specimens figured on this plate are in the author's collection unless otherwise stated.



K.M.Chapman del.

Richetype Collection.

PLATE XXXI

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-10. **Forbesiocrinus saffordi** Hall..... 259

(Also on Plates XXI and XXX)

FIG. 1*a*. The type, presented to the author by Prof. J. M. Safford; right anterior view. It is a very mature specimen, showing the lobed calyx, arching of rays, and depression of anal and interbrachial areas; also the prominent gibbosity of the axillary IIBr followed by flat plates. White's Creek, Tennessee.

1*b*. Basal view of same, anal side to the left; posterior B truncate, followed by one plate.

1*c*. IIIBr from same, showing pustulose surface. × 2.

2*a*. Young specimen from Spergen Hill, Indiana, posterior view. Shows plates of anal side perfectly.

2*b*. Basal view of same. IBB in place, with central part of thin columnal adhering. Note the large size of the interbrachial plates.

3*a*. Detached base from same locality, with IBB and proximal columnal attached, dorsal view.

3*b*. Interior view of same; showing the crenulations and small fossae upon the sutural margin of radials; small infrabasal located anteriorly.

3*c*. Lateral view of same, showing distal unpaired articulating face of radial, and sutural margins for attachment of iBr.

4*a*. Proximal part of detached column, with IBB fused to top columnal; lateral view. Spergen Hill, Indiana.

4*b*. Ventral view of same, showing the tri-lobate funnel or raised rim of axial canal as it opens through the infrabasals.

5. Fragment of a ray, showing the prominent axillary IIBr, same locality.

6*a*. Another fragment from same locality, being part of a ray from IBr up, exterior view. The plates are marked for comparison with the next figures—the brachials with figures, the interbrachials with letters.

6*b*. Interior view of same, with plates similarly marked. It shows by comparison with 6*a* how the brachials diminish in size inward, and the interbrachials are wedged in from the inside to fill up the spaces.

6*c*. Right lateral view of same, showing corrugated margin of the brachials for attachment of interbrachials.

6*d*. Lateral margin of IIBr 1 and 2 of same. × 2.

7*a-e*. Another fragment from same locality, consisting of IBr_3 and following plates: 7*a*, exterior; 7*b*, interior; 7*c*, distal face of Br and iBr; 7*d*, left lateral margin for attachment of iBr; 7*e*, proximal face of IBr_3, showing paired ligament fossae. × 2.

8. Proximal part of stem, showing extreme thinness of the columnals, and the crenulate profile of the radiating striae on their apposed faces. × 2 (enlargement fraction omitted on plate).

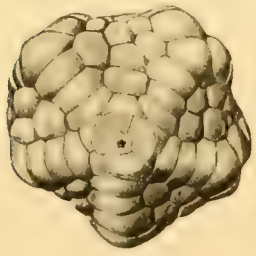
9. Similar specimen, a little farther down. × 2.

10*a*. Calyx of another specimen from same locality, showing a somewhat different style of marking on the articulating and sutural margins. × 2.

10*b*. Another view to show distal face of IBr_2, with rather irregularly paired ligament fossae. × 2.

Warsaw limestone, Lower Carboniferous at Spergen Hill, Indiana; and highest Keokuk, White's Creek, Tennessee.

All specimens figured are in the author's collection.



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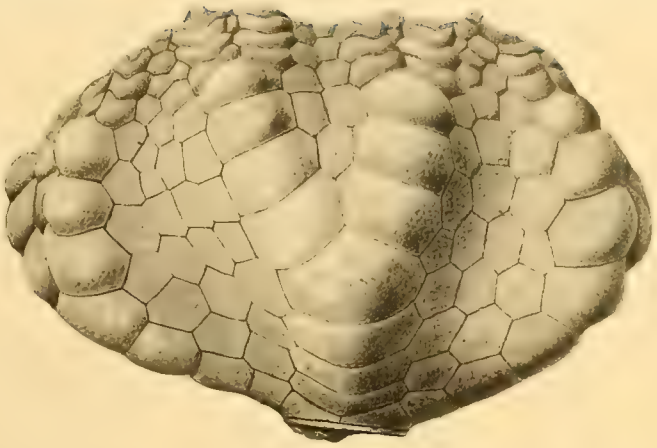

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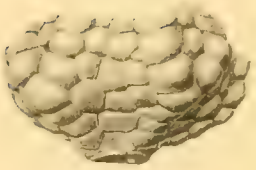

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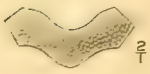

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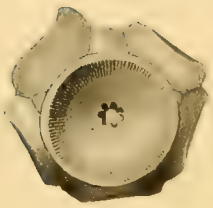

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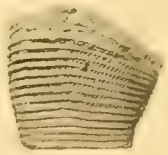

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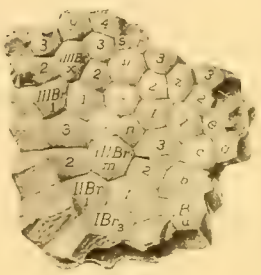
6a

7d



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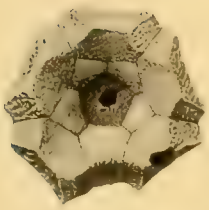

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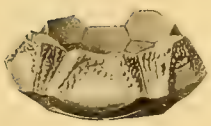

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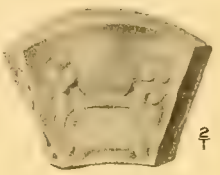
6c

7b



7e

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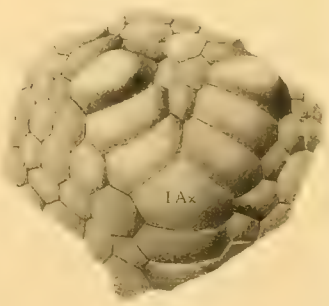
4a

7c

4b



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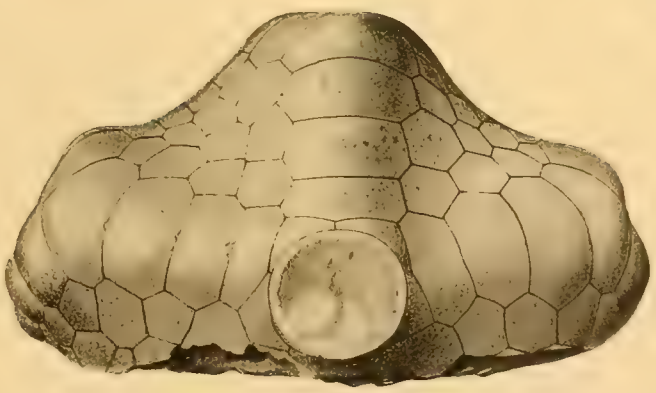

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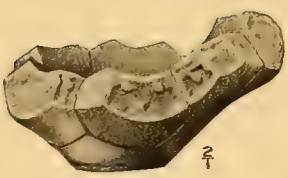

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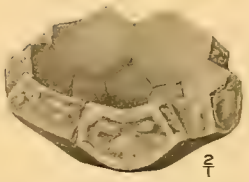

10b

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PLATE XXXII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-13. **Ichthyocrinus pyriformis** (Phillips) 273

FIG. 1. Phillips's type specimen, having part of stem, and crown complete. After Phillips in Sil. Syst., pl. 18, fig. 6. Location of specimen unknown. Dudley, England.

2*a*. Specimen from same locality in author's collection, almost identical in form and size of crown; r. ant. view. Shows 4 primary plates (RA + R + 2 IBr) in r. post. ray; basals visible beyond column. Crown undistorted, showing natural contour.

2*b*. Enlarged view, from r. post. radius, showing the much reduced size of RA, while similar in form to radials in other rays. × 2.

2*c*. Basal view, showing IBB, BB, RR, and IBr in all five rays, and RA in r. post. ray. IBB entirely within ring of BB, and occupying only small space in center of column facet.

2*d*. Detail of IBr_1, showing pustulose surface ornament. × 4.

3. Similar specimen from Dudley, r. post. radial view. × ¾. Author's collection.

4*a, b*. Lower part of crown of specimen from Dudley, anterior and basal views. British Museum, E6349.

5*a*. R. post. radial view of similar specimen with surface ornament well preserved. × 2. British Museum, E6353. Dudley, England.

5*b*. Basal view of same. Natural size.

6. Less pyriform specimen, slightly distorted. British Museum, E5598. Dudley, England.

7*a*. Larger specimen with more turbinate calyx; anterior view. × ¾. Author's collection. Dudley, England.

7*b*. Detail of IBr_1, showing pustulose surface ornament, coalescing into lines parallel to margins. × 4.

8. Similar and larger specimen, with plates relatively larger than in any of the preceding. × 2. British Museum, E7424. Dudley, England.

9*a*. Original of Angelin, pl. 22, fig. 22, slightly distorted; from r. post. radius. Riks Museum. Gotland, (Wisby *f*).

9*b*. Same from left posterior radius. × 2.

9*c*. R. post. ray of same to first division, showing RA. × 2.

9*d*. R. ant. radial view of same, for comparison of size of radial with RA in last figure. × 2.

9*e*. Outline of same specimen if undistorted.

10*a*. Similar specimen from r. post. radius. × 2. Riks Museum. Gotland, (Dalhem *d*).

10*b*. Basal view, showing RA in primitive position and other plates to first ray division in all five rays. × 2.

11*a*. Original of Angelin pl. 9, figs. 17*a-c*,—flattened and distorted specimen from Faro, Gotland (*d* or *f*); from r. post. radius. × ¾. Riks Museum.

11*b*. Same from l. ant. radius, malformed and injured by parasites such as *Stylifer*, or *Eulima*. × 2.

11*c*. Basal view, showing IBB within ring of BB, and RA. × 2.

11*d*. Same from r. post. radius, showing RA in primitive position. × 2.

11*e*. Detail of l. post. IIBr 3 and 4, showing pustulose surface ornamentation. × 3.

11*f*. Part of l. post. $IIBr_3$, showing surface ornament in greater detail. × 8.

11*g*. Outline restoration of this specimen to show actual contour; r. post. view.

12*a*. Fragment from Faro, containing part of two rays from the first axillary to IVBr, showing injury by boring parasites. × 2. Riks Museum.

12*b*. Part of same further enlarged, showing the strong surface ornament. In the upper ranges of plates may be seen several of the "patelloid" processes cracked in fossilizing and appearing like separate plates. × 3.

13*a*. Unusually large specimen, somewhat flattened, from Follingbo (*f*); lateral view of crown with stem. Riks Museum.

13*b*. Base of same, enlarged × 2.

13*c*. Outline restoration of this specimen giving correct contour; from l. post. interradius. Wenlock Gr.; Silurian. England and Gotland, Sweden.

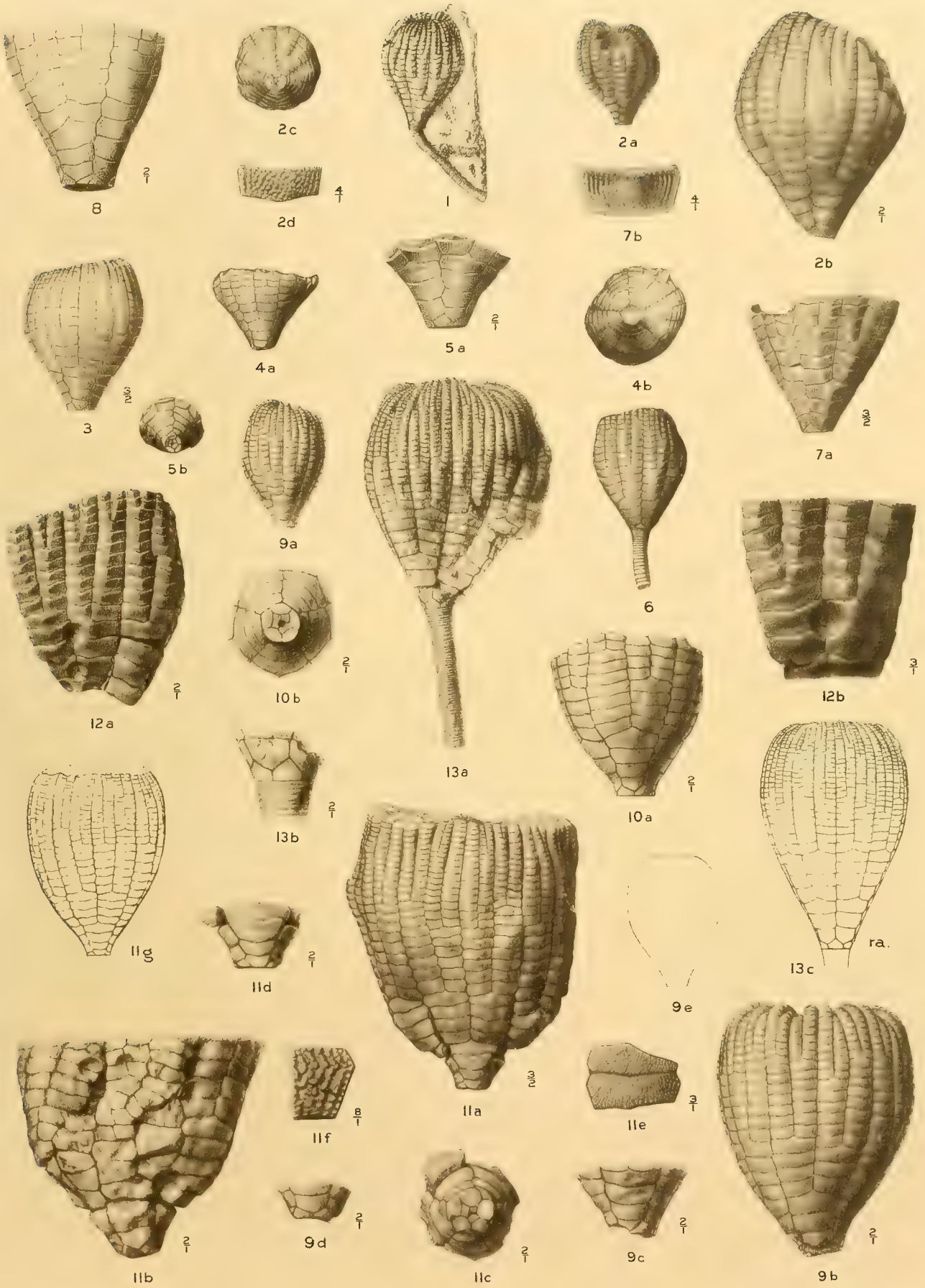

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PLATE XXXIII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-13. **Ichthyocrinus laevis** Conrad..... 277

FIG. 1. Conrad's type specimen much flattened; from his figure, Jour. Acad. Nat. Sci., Phil., Pl. XV, fig. 16. Specimen cannot be found. Lockport, New York.

2. Original of Hall, Pal. N. Y., Vol. II, pl. 43, fig. *2b*—a flattened specimen; right anterior view. Am. Mus. Nat. Hist. Lockport, New York.

3*a*. A very fine mature specimen, complete crown, with perfect contour below the arms; anterior view, showing pyriform calyx and BB but little visible beyond the column. Am. Mus. Nat. Hist. Lockport, New York.

3*b*. Oblique basal view, showing perfect rotundity of the specimen, and the IBB entirely within ring of BB; posterior interradius up.

3*c*. Brachial plates at third axillary, showing a regular median radial ridge, and the imbrication of plates.

3*d*. Enlarged cross-section of surface of brachials, showing the sharp imbrication of plates.

4*a*. Medium sized undistorted specimen, showing almost perfect contour of crown; right anterior view, showing pyriform calyx and BB visible at side. Author's collection. Lockport, New York.

4*b*. Basal view of same, showing posterior rays to second division.

5*a*. Original of Hall's pl. 43, fig. *2c;* complete crown of young specimen, undistorted, antero-lateral view. The second bifurcation of rays is about half way up. Am. Mus. Nat. Hist. Lockport, New York.

5*b*. Basal view, showing right posterior ray, with RA and base, together with parts of other rays.

6*a*. Younger specimen, also with perfect contour, posterior view. The second bifurcation of rays is three-fourths to top of crown. Author's collection. Lockport, New York.

6*b*. Basal view of calyx, showing right posterior ray.

7. Very young specimen slightly compressed, lateral view; showing second bifurcation of rays at very top of crown. Author's collection. Lockport, New York.

8. Still younger, perfectly rotund, specimen with stem and crown complete; but one bifurcation of rays visible. Extreme juvenile stage of stem shown by great elongation of distal columnals, and absence of any intercalated ossicles. Author's collection. Lockport, New York.

9*a*. Detached base to show the basal structures in detail; exterior view with top columnal attached; canal faintly pentangular. × 2. Author's collection. Lockport, New York.

9*b*. Interior view of basal plates; showing triangular funnel shaped opening projecting from the inner floor of IBB and entirely concealing them. × 2.

9*c*. Same parts further enlarged, showing lobes of the axial canal passing down from the funnel interradially. × 3. See text-figure 1*a* for further detail.

10*a*. Complete crown with stem attached; medium sized flattened specimen, right posterior radial view. Author's collection. Lockport, New York.

10*b*. Outline of crown if undistorted.

11*a*. A larger flattened specimen from Lockport, anterior view. Author's collection.

11*b*. Outline of crown as in its natural contour.

12*a, b*. A still larger specimen, with similar outline. Author's collection. Lockport, New York.

13*a*. The largest known specimen, laterally compressed; right anterior interradial view, showing arms to sixth division. It has six bifurcations in some of the rays. Coll. Sir Edmund Walker, now in the University of Toronto. Grimsby, Ontario; Canada.

13*b*. Basal view of same; RA and greater part of BB included in column facet.

13*c*. Outline restoration of the specimen, to show its natural contour.

Niagaran, Rochester shales; Silurian. Lockport, New York, and Grimsby, Ontario.

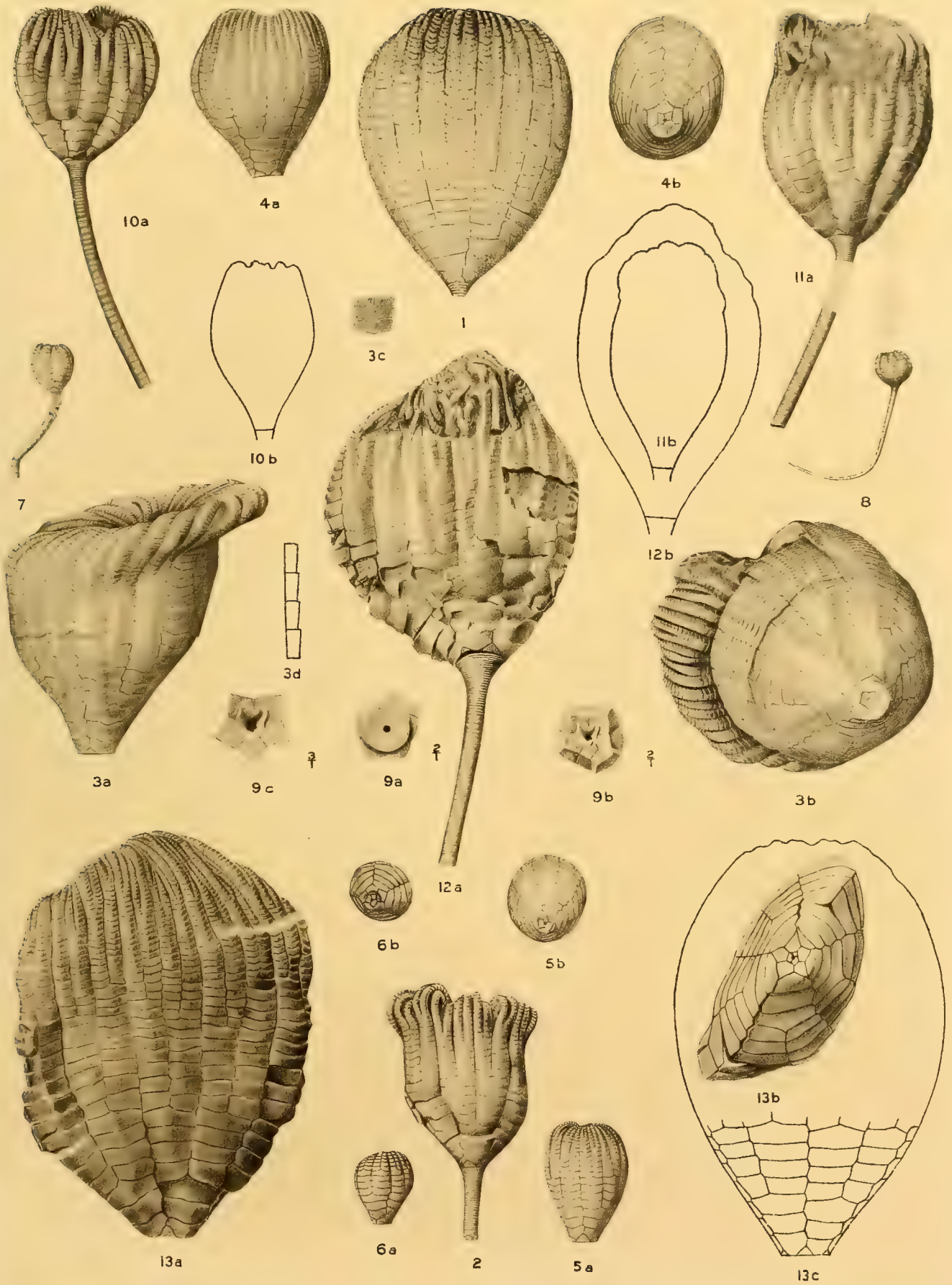

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PLATE XXXIV

PAGE

Figs. 1-10. **Ichthyocrinus subangularis** Hall..... 281

FIG. 1. The type specimen from which the species was originally described, subsequently figured in 20th Regents Report, pl. 11, fig. 16; somewhat flattened. Right posterior interradial view, showing RA, and the large BB visible in side view.
Am. Mus. Nat. Hist. Waldron, Indiana.

2*a*. A normal specimen, with calyx preserved to the second bifurcation, antero-lateral view. It has no surface markings; IBB injured. Author's collection. Waldron, Indiana.

2*b*. Postero-basal view. Shows relative proportions of plates of base and lower part of rays, especially the form and size of RA as compared with the regular radials.

3. Posterior view of similar specimen with base perfect. Author's collection.
Waldron, Indiana.

4. Lower part of calyx of another specimen, left posterior view; showing large size of basals. Author's collection. Waldron, Indiana.

5. Basal view of another specimen from same collection and locality.

6. The original of Hall's fig. 13, plate 15, in 11th Indiana Report; a very elongate specimen of maximum size, with 5 IIBr in one ray. New York State Museum.
Waldron, Indiana.

7. Hall's Bridgeport specimen (20th Regents Rep., pl. 11, fig. 15), having the test partly preserved; base wanting. Am. Mus. Nat. Hist.
From the Racine dolomite. (Bridgeport) Chicago, Ill.

8. A perfectly characteristic specimen from the same locality, internal cast; from right posterior interradius; RA visible to left. Author's collection.

9. Younger specimen from same locality, with more spreading calyx and shorter plates; left posterior view, RA visible to right. Author's collection.

10*a*. Perfect crown perhaps of this species, from the Rochester shales, Lockport, New York, anterior view. Author's collection.

10*b*. Basal view, showing plates of the base and two posterior rays.
Niagaran; Waldron, Racine and Rochester beds; Silurian. Waldron, Indiana, Chicago, Illinois, and Lockport, New York.

Figs. 11-14. **Ichthyocrinus intermedius** Angelin..... 282

FIG. 11*a*. The type, original of Angelin, pl. 17, fig. 7; a complete crown, flattened; from left posterior interradius, showing extra plate in left anterior ray. $\times \frac{3}{2}$. Riks Museum.
Faro (*d*).

11*b*. Lower portion of calyx, from left anterior ray. The lower plate (radial) in this ray is of normal size compared with that in other rays. $\times 2$.

11*c*. The same from right posterior ray, showing the diminished size of the lower plate (radianal) compared with that of l. ant. ray. $\times 2$.

11*d*. Basal view, showing relative proportion of plates of base, and first ray division. $\times 2$.

11*e*. Surface of IIIBr, showing merely granulation, or superficial meshes of stereom, and not a true ornamentation. $\times 12$.

11*f*. Outline restoration to show the true contour of crown.

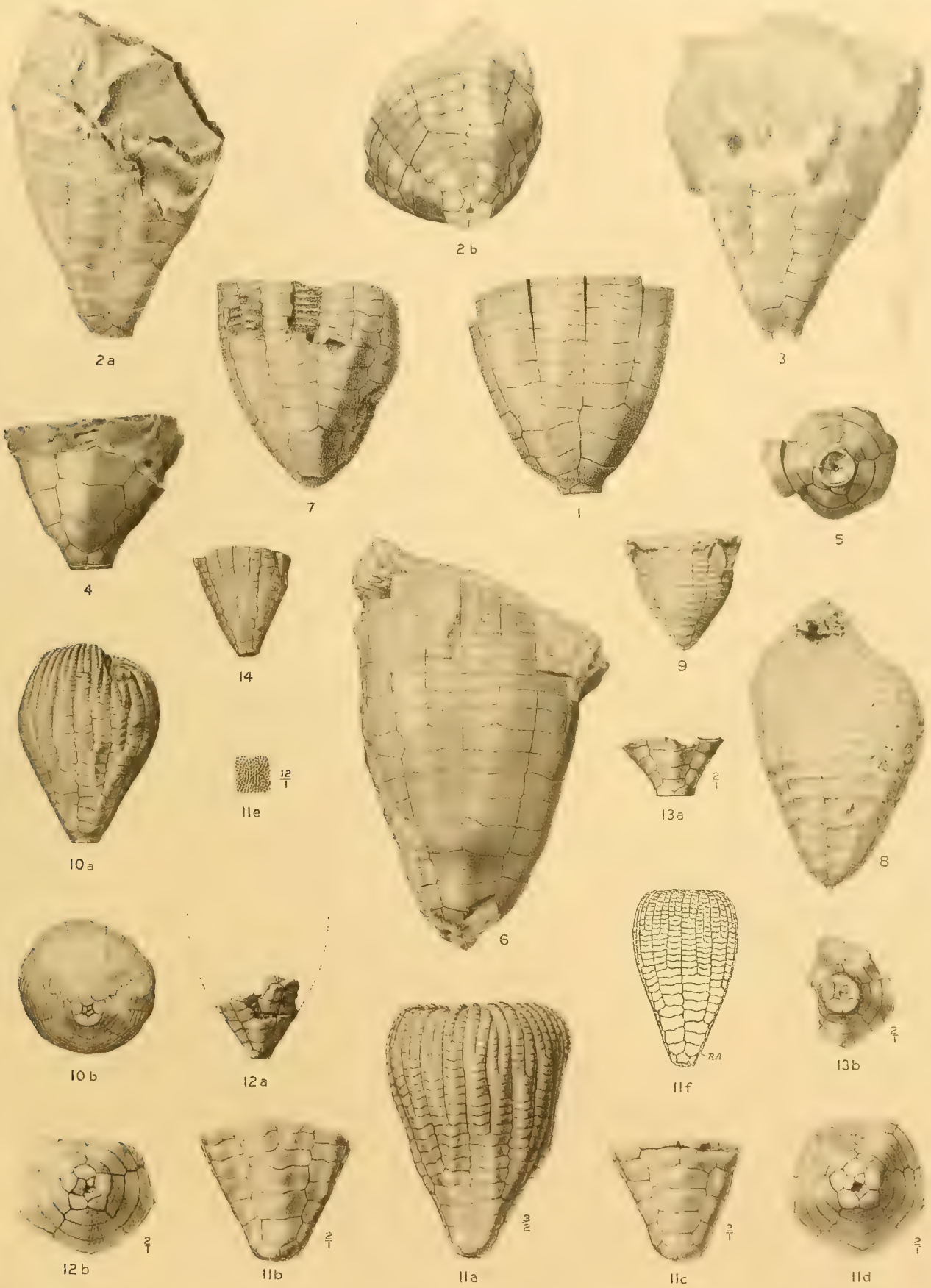
12*a*. Lateral view of a fragmentary calyx, with probable outline of crown indicated. Riks Museum. Dalhem (*d*).

12*b*. Basal view of same. $\times 2$.

13*a*. Right posterior view of smaller specimen from Nas (*d*). $\times 2$. Riks Museum.

13*b*. Basal view of calyx. $\times 2$.

14. A specimen from Dudley, England, perhaps of this species. Author's collection.
Wenlock Gr.; Silurian. Gotland, Sweden, unless otherwise stated.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11b
11a
11c
11d
RA

PLATE XXXV

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-16. **Ichthyocrinus gotlandicus** Wachsmuth and Springer..... 275

FIG. 1*a*. The type, original of Angelin, pl. 22, figs. 20, 21, as *I. laevis;* r. post. radial view. Shows BB barely exposed at their angles; RA under r. post. ray; and 3 IIBr. × 2. Likkershamm (*c*).

1*b*. Opposite side of same.

2*a*. Fragmentary specimen from same locality, lateral view.

2*b*. Basal view of same. IBB resorbed; BB and RA confined to column facet. × 2.

3*a*. Specimen from Vamlingbo (*d*), somewhat compressed vertically; from l. post. radius. BB invisible in side view; has 4 IIBr in some rays. × 2.

3*b*. Basal view of same. IBB resorbed. × 2.

4*a*, *b*. Anterior and basal views of another specimen from same locality. IBB resorbed, and BB invisible from side. × 2.

5. Another specimen from same locality in similar condition. BB and RA confined to column facet. × 2.

6*a*. Very young specimen from same locality; l. ant. radial view.

6*b*. Same view enlarged. × 2.

6*c*. Same; ornament on IIBr and IIIBr. × 3.

6*d*. Basal view of same, showing IBB not yet resorbed. × 2.

6*e*. Cross-section of base, constructed from foregoing figures; showing IBB (indicated by vertical hatching) in form of a plug entirely within the ring of BB. × 5.

7. Another small specimen from same locality, showing more rotund form of crown in younger stage.

8, 9*a*. Mature specimens from same locality, not compressed, showing normal outline.

9*b*. Base of 9*a*, showing surface ornament. × 3.

10. Specimen from same locality not compressed, with calyx narrower below.

11. Compressed specimen from same locality with rather long IBr; from r. ant. interradius. × 2.

12. IIBr and IIIBr of crushed specimen, showing ornament and traces of parasites. × 3. Same locality.

13. Fragment; IIBr and IIIBr, showing ornament, with imbricated margins not seen on other specimens; same locality. × 2.

14*a*. Variety with straighter sides and longer brachials; r. ant. view. × 2. Same locality.

14*b*. Right posterior view of same; radianal almost covered by the column. × 2.

14*c*. Outline restoration of same.

15*a*. Variety from Amundi, horizon (*f*), with more pyriform crown, and arms preserved; posterior view; mentioned by Angelin on p. 13, as *I. pyriformis*. × 2. Museum Geol. Survey of Sweden.

15*b*. Anterior view of base; has an extra plate in ant. ray. × 2.

15*c*. Basal view of same, BB slightly visible beyond the column; IBB resorbed. × 2 (enlargement fraction omitted on plate).

16. Fragment of similar specimen from $IIBr_2$ up, showing detail of arms to at least the sixth bifurcation, and coiling of the ultimate ray divisions. Note the great depth of the brachials dorso-ventrally. × 3. Same locality.

Wenlock Gr.; Silurian. Gotland, Sweden, unless otherwise stated.

All the specimens except fig. 15 are in the Riks Museum, Stockholm.

Figs. 17. **Ichthyocrinus devonicus** n. sp..... 290

FIG. 17*a*. The type, anterior view; a compressed specimen, surface considerably worn, but with faint traces of ornament in some places. BB entirely covered by the column. Author's collection.

17*b*. Opposite view showing the arms to the last bifurcation.

17*c*. Outline restoration, showing contour of the specimen if undistorted.

Helderbergian; Lower Devonian. Benton County, Tennessee.

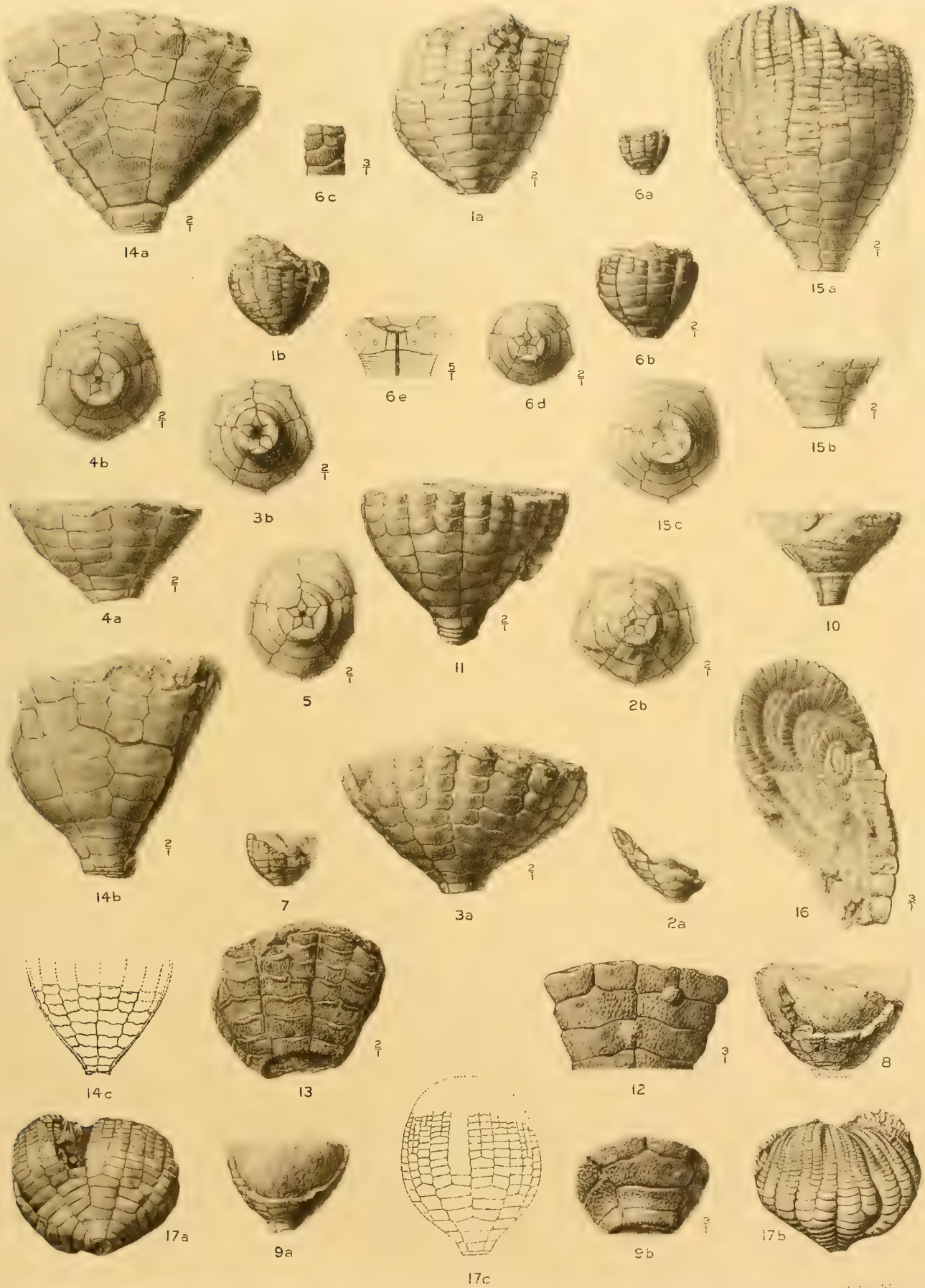

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PLATE XXXVI

(All figures natural size except where otherwise stated)

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Figs. 1-7. **Ichthyocrinus corbis** Winchell and Marcy..... 285

FIG. 1. A typical specimen in the condition as usually found in magnesian limestone, with all plates removed by chemical action, leaving a cast (made by the substituted matrix) of the inner surface of the test, with sharp ridges or fine lines at the sutures. The lower part of the calyx is unsymmetric, being thrown out of line of vertical axis by excessive convexity at one side, and corresponding concavity opposite. Basal view, showing small RA as inferradial under r. post. ray, smaller than RR in other rays; small BB, probably not larger than column facet, and cast of space for IBB which were probably resorbed. The convexity in this specimen is at the anterior side.

2. Basal view of similar specimen, with the convexity at the posterior side, showing that the distortion is not due to anal structures; RA very small.

3*a*. Left posterior radial view of a maximum specimen, perfectly rotund except for the usual distortion at the base, where the convexity is at the right anterior side. Shows the general contour of crown; the 4 IIBr; and the space for the resorbed IBB represented by a plug of the infiltrating matrix.

3*b*. Direct view of base of same, showing outline of BB, and plug filling space for the resorbed IBB. × 3.

4. Smaller specimen, right posterior radial view; convexity at left anterior side. Note small size of RA.

5. Still smaller specimen, basal and right posterior interradial view; convexity at left anterior side.

6*a*. A very large specimen, with part of the plates remaining; viewed from convex side of calyx, orientation not ascertainable owing to injury of base. Shows that the sutures are externally sinuous, although straight at the inner surface as always appearing in the casts; 5 IIBr in some rays of this specimen.

6*b*. View of same with convexity to the left, showing the original plates above the primibrachs, with obscure radial ridges.

6*c*. Outline vertical section; to show relative thickness of plates, especially their extreme thinness in lower part of calyx wall, indicating the probable manner of distortion from weight of viscera. Composed from specimens 3 and 6; shaded lines in base represent space of resorbed IBB.

7. Young specimen figured by S. A. Miller (Jour. Cinn. Soc. Nat. Hist., Vol. IV, pl. 4, fig. 5) as the true *I corbis,* having the plates preserved. Figured here for comparison; its elongate calyx, straight sides, and large BB, showing clearly that it belongs to *I. subangularis,* and not to this species. Chicago Academy of Science.

Niagaran, Racine dolomite; Silurian. From quarries at what was formerly Bridgeport, now in the City of Chicago, Illinois.

Figs. 8-12. **Ichthyocrinus conoideus** Ringueberg..... 283

FIG. 8*a*. The type figured by Ringueberg, l. post. radial view; appears more rapidly expanding than the average of numerous specimens, partly due to flattening.

8*b*. Basal view of same, showing small, but well developed IBB; RA under r. post. ray.

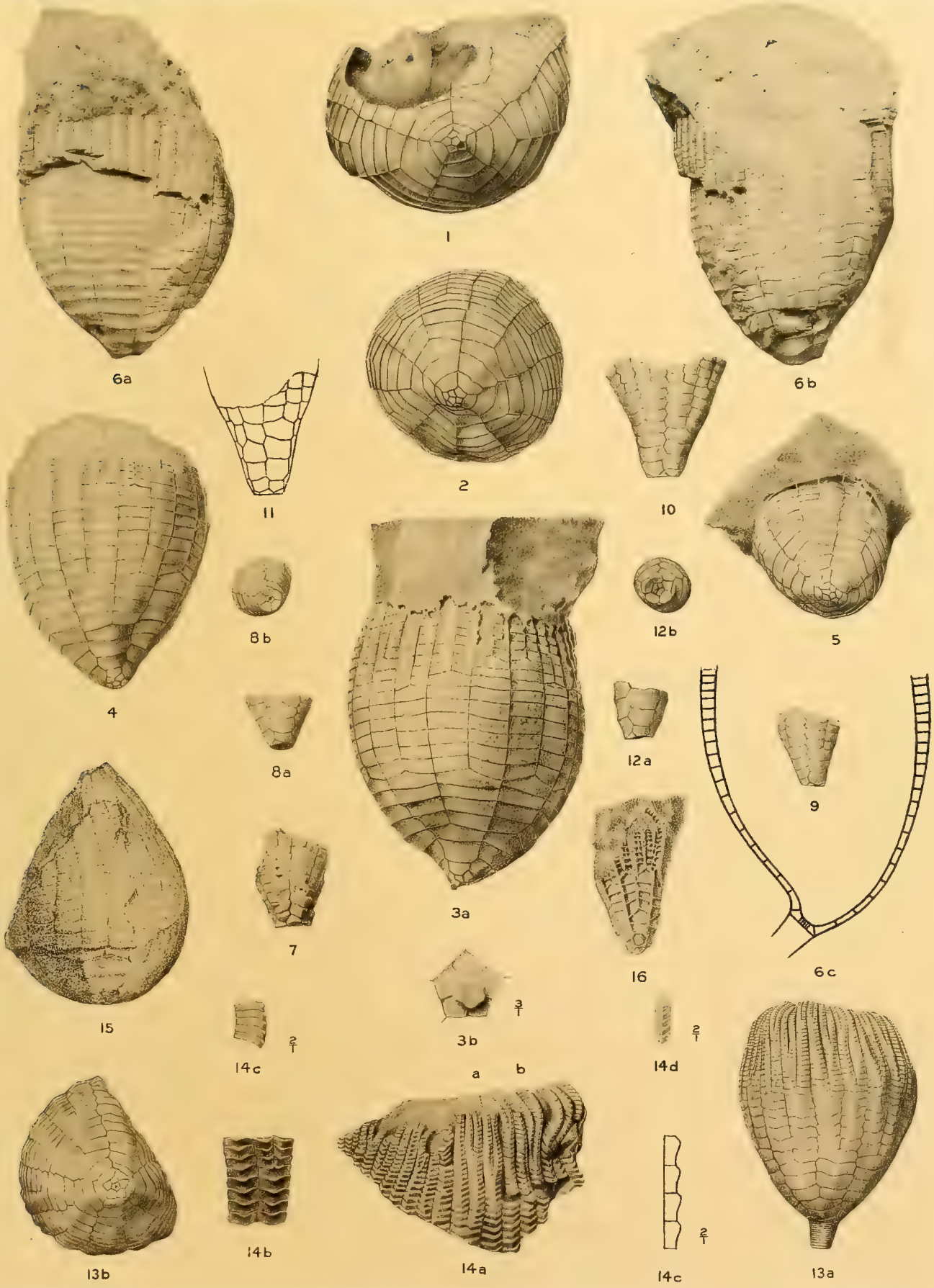
9. Cotype used in description, slightly flattened; showing the extreme narrowness and slight spreading of calyx as usually found; the absence of radial ridges; and the BB visible only as points.

10. Large flattened specimen, showing crown to $IIIBr_4$, and small size of BB in side view.

11. Outline of a rotund specimen, showing about the normal contour of crown.

12*a, b*. Lateral and basal views of specimen with very high brachials, and yet the usual low BB.

Niagaran, Gasport limestone; Silurian. Lockport, New York.



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PAGE

Figs. 13-14. **Ichthyocrinus phillipsianus** n. sp..... 284

FIG. 13*a*. Lateral view of mature specimen; a complete crown showing about the natural contour, and the sharp prominent radial ridges.

13*b*. Basal view of same, with stem removed. Shows small, but distinct, IBB; BB entirely within the column facet, and the RA also, so that it could not be seen from the side; IIBr mostly 4.

14*a*. Distal portion of arms, from another specimen, crushed and much broken.

14*b*. IIIBr from another part of same specimen, showing the raised margin of the plates.

14*c*. Dorso-ventral section of same, showing the raised margin to be curved, and not imbricated. × 2.

14*d*. Dorsal view of an arm near last bifurcation, showing the extreme angularity. × 2.

14*e* (erroneously printed as *c*). Lateral view of arm a little higher up, showing the great depth of brachials, and the downward curving of the "patelloid" processes and their sockets. × 2.

Wenlock Gr.; Silurian. Dudley, England.

Fig. 15. **Ichthyocrinus bohemicus** (Barrande MS.)..... 291

FIG. 15. After Waagen and Jahn, pl. 61, fig. 7. × ½. Collection Barrande, Prague, Bohemia. Lower Devonian, Stage F^2. Koneprus, Bohemia.

Fig. 16. **Ichthyocrinus** sp..... 360

FIG. 16. Specimen figured by Sandberger (Versteinerungen, pl. 35, fig. 17*b*) as *Taxocrinus rhenanus*, from the Lower Devonian, near Coblentz, Germany. Internal cast, perhaps of this genus, more probably of *Clidochirus*. (After Sandberger.)

All specimens on this plate are in the author's collection unless otherwise stated.

PLATE XXXVII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-6. **Clidochirus pyrum** Angelin..... 296

FIG. 1. The type, original of Angelin, pl. 22, fig. 23, slightly flattened; posterior view with missing parts of base restored in outline. Shows the large BB; large RA under r. post. ray; and the anal series with rays arching over and abutting above it. ×2. Riks Museum. Wisby (*c*).

2. Very young specimen, uncompressed, with proximal columnals attached and surface ornament in perfect preservation; right posterior view. ×$\frac{5}{2}$. Riks Museum. Wisby (*c*).

3*a*. A perfect crown, but little flattened, with column probably nearly complete; figured by Angelin (pl. 17, fig. 6) as *Ichthyocrinus pyriformis;* right posterior view. The great increase in length of the distal columnals indicates that they are near the end. ×$\frac{3}{2}$. Riks Museum. Wisby (*c*).

3*b*. Posterior view of lower part of crown after removal from the stone, showing the complete anal structure of this genus. ×$\frac{3}{2}$.

4*a*. Fragment of IIIBr from Snackgärdet (Wisby *d*), showing character of the ornamentation. ×3 (enlargement fraction omitted on plate). Riks Museum.

4*b*. IIIBr from the same, further enlarged, showing the strong vertical wrinkles upon a granular background. ×8.

5*a*. A large and nearly complete, flattened specimen, with surface markings mostly removed by weathering; anterior view. Riks Museum. Tofta (*c*).

5*b*. Posterior view of same.

5*c*. Basal view of calyx.

6. A worn specimen with surface markings destroyed; rays a little more angular than usual. Natural size. Author's collection. Wisby (*c*).

Wenlock Gr.; Silurian. Gotland, Sweden.

Figs. 7-8. **Clidochirus americanus** n. sp..... 298

FIG. 7*a*. A nearly complete crown, anterior view. Author's collection.

7*b*. Right posterior radial view, showing small size of RA.

8. Another specimen from same locality with nearly complete stem; right posterior interradial view, showing the same small RA. Author's collection.

Clinton Gr.; Silurian. Dayton, Ohio.

Figs. 9-11. **Clidochirus keyserensis** n. sp..... 298

FIG. 9*a*. Specimen with complete crown, but little flattened; posterior view, showing the deeply rounded rays, and the long anal series. Author's collection.

9*b*. Basal view of same.

10. Anterior view of another specimen with brachials more angular. Author's collection.

11. Outline restoration based upon the foregoing, and another specimen with column preserved. Author's collection.

Helderbergian; Lower Devonian. Keyser, West Virginia.

Figs. 12, 13. **Clidochirus schucherti** (Talbot)..... 299

FIG. 12*a*. The type, original of Miss Talbot's *Ichthyocrinus schucherti* (Am. Jour. Sci., XX, Pl. III, fig. 1); anterior radial view. Complete crown in nearly natural contour, with part of column. Yale University Museum.

12*b*. Right posterior view of same; anal side cannot be seen in the specimen, but the very large basals deny *Ichthyocrinus.*

13*a*. A specimen from Schoharie, New York, right anterior view. Author's collection.

13*b*. Right posterior view of same, showing the anal and radianal plates.

Helderbergian; Lower Devonian. Clarksville and Schoharie, New York.

Fig. 14. (?) **Clidochirus greenei** (S. A. Miller)..... 300

FIG. 14. The type. Original of Plate 8, fig. 3, Adv. Sheets, 18th Rep. Geol. Surv. Indiana, as *Ichthyocrinus greenei;* anterior view, anal side unknown. Jefferson County, Kentucky; said to be Lower Carboniferous, but may be Silurian. Coll. Mr. Geo. K. Greene, now in Am. Mus. Nat. Hist. New York.

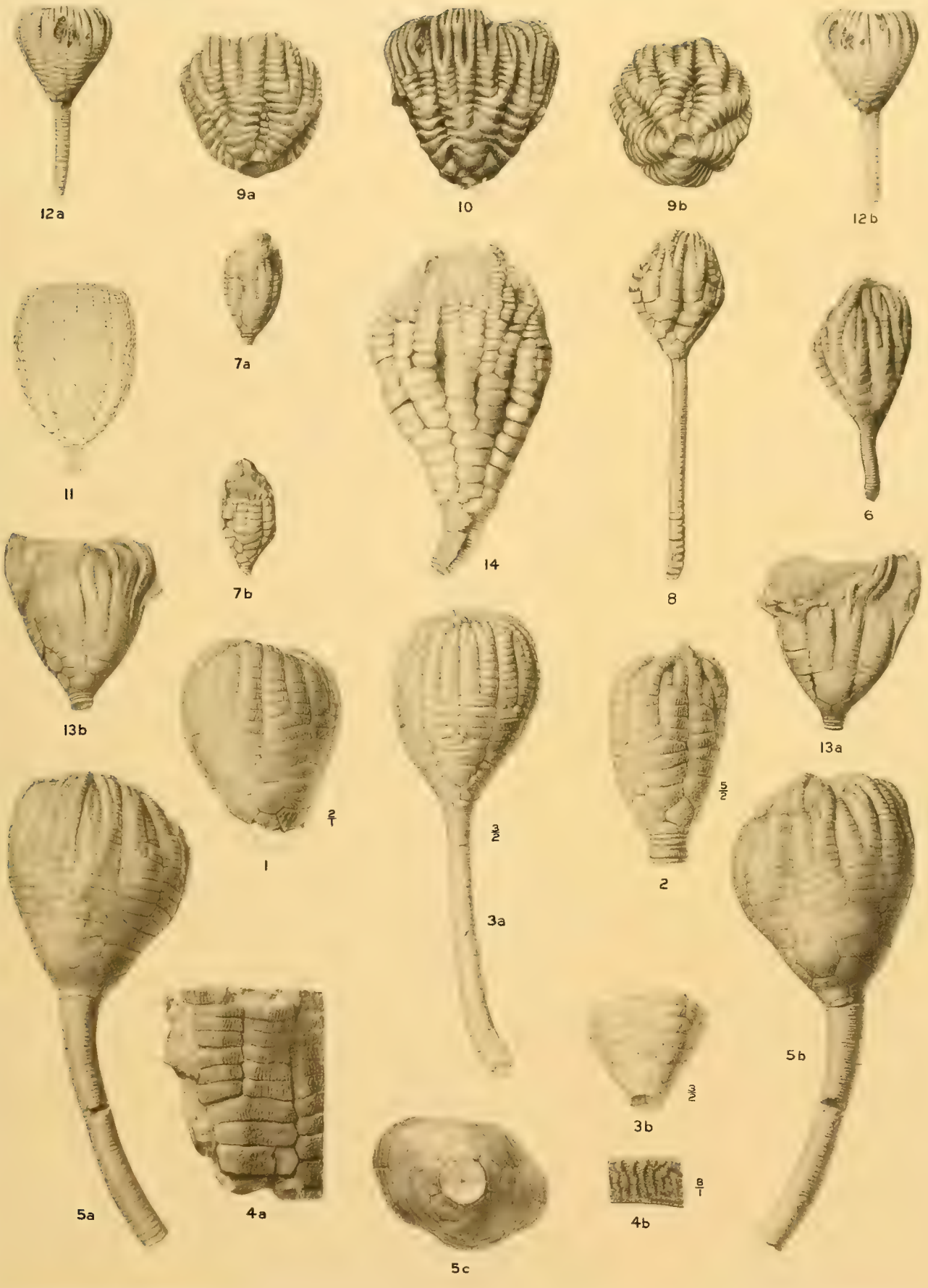

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PLATE XXXVIII

PAGE

(All figures natural size except where otherwise stated)

Figs. 1-2. **Cleistocrinus humilis** (Angelin) 293

FIG. 1*a*. A cotype, anterior side view of calyx; original of Angelin, pl. 23, figs. 28, 28*a*, as *Calpiocrinus humilis*. Natural size. Riks Museum. Klinteberg (*f*).

1*b*. Posterior view of same.

1*c*. Basal view of same after stem ossicles removed. Shows IBB completely resorbed; BB, RA and RR wholly included in the column facet; anal *x* not connecting with B. × 2.

1*d*. Interior view of same; an interbrachial plate partly formed at right of *x*, but not reaching to the exterior. × 2.

2*a*. Dorsal view of the other cotype; Angelin, pl. 23, figs. 28*b*, *c*; pl. 26, fig. 17. All plates below IBr concealed by the column. × 2. Riks Museum.

2*b*. Interior view of same; IBB and part of BB resorbed; RR meeting below anal *x*. × 2. Wenlock Gr.; Silurian. Gotland, Sweden.

Figs. 3-6. **Synaptocrinus nuntius** (Hall) 302

FIG. 3*a*. The type, original of Hall, pl. IA, fig. 12; a crushed specimen, from l. post. interradius, showing surface ornament and lateral projection of brachials. Am. Mus. Nat. Hist. Erie County, New York.

3*b*. Basal view of same, showing IBB within ring of BB, and the large post. B.

4*a*. A mature specimen with stem, and arms to fourth bifurcation, somewhat flattened; from r. ant. interradius. Lateral extension of brachials continued to highest plates. Author's collection. Bellona, New York.

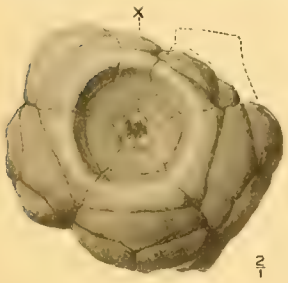
4*b*. Posterior view of same, showing large angular post. B with no anal plate succeeding.

4*c*. Restoration of crown, showing the normal contour.

4*d*. Diagrammatic view of base, composed from this specimen and the type; to show relation of basal plates.

5. Posterior view of a small specimen from Erie County, New York, showing angular form of post. B. × 2. Columbia University, New York.

6. Anterior view of another specimen from Erie County, New York, showing characteristic form and sculpturing of plates. Author's collection. Hamilton Gr.; Middle Devonian. New York.



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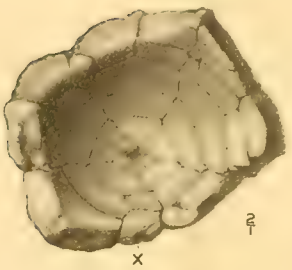

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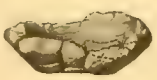
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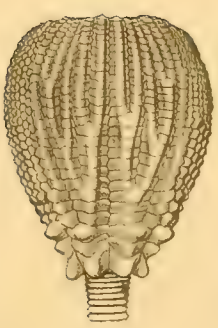
2a

3b

3a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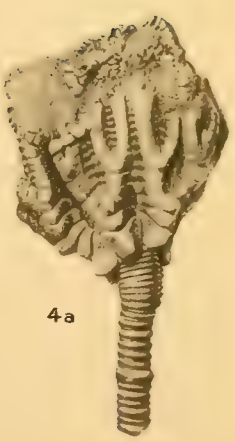
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PLATE XXXIX

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-7. **Metichthyocrinus burlingtonensis** (Hall)..... 322

FIG. 1. Maximum specimen with stem and arms complete, flattened. BB showing beyond column.
2*a*, *b*. Perfect crown of about average size, laterally compressed; lateral and basal views.
2*c*. Outline restoration, showing correct proportions, if undistorted, of the pyriform crown.
3*a*. Basal view of somewhat larger specimen.
3*b*. Base of same, enlarged. × 2.
4*a*, *b*. Lateral and basal views of similar specimen, with proximal columnal concealing IBB and most of BB.
5*a*. Smaller specimen, lateral view.
5*b*. Base of same enlarged, showing IBB and large BB. × 2.
6*a*. Basal view of a specimen with rays removed beyond IBr; IBB and all of BB except their angular points concealed by proximal columnal. × 2.
6*b*. Interior view of same, showing IBB and BB. Note how much smaller the inner surface of IBB than the outer in the relatively smaller specimen, 5*b*. × 2.
7. Section of another specimen vertically fractured, showing the probable limits of the tegmen. × 2.

Lower Burlington limestone; Lower Carboniferous. Burlington, Iowa.

All specimens figured are in the author's collection.

Figs. 8-18. **Metichthyocrinus clarkensis** (Miller and Gurley)..... 323

FIG. 8. The type; from near Henryville, Clark County, Indiana. University of Chicago.
9*a*. Lateral view of a perfect crown, somewhat compressed. Author's collection.

Knobs south of Louisville, Kentucky.

9*b*. Opposite side of same, showing a few sporadic interbrachial plates; note also the imbrication at the sutures.
9*c*. Outline restoration of same as it would appear if undistorted, showing the pyriform shape.
10. Complete nearly rotund crown, with part of stem attached. Author's collection.

White's Creek, Tennessee.

11*a*. Base and lower part of a calyx from a knob south of Louisville, Kentucky; dorsal view, showing IBB and BB, the latter visible as small points beyond the column facet.
11*b*. Ventral view, showing inner surface of same plates. Note their diminished size at the interior.
11*c*. Basal and infrabasal plates of same, exterior view; showing small axial opening. × 3.
11*d*. Interior view of same; showing diminished size of the plates, and the funnel-shaped trilobate rim of the axial opening toward the interior. × 3.
12. Vertical section through axial opening of another specimen from the same locality, showing relative proportions of IBB and BB, and two columnals below them filling the facet. × 2.
13*a*, *b*. Exterior and interior views of another specimen from same locality.
14. Specimen from Button Mould Knob, Kentucky; basal view. BB visible beyond the column facet.
15. Base of specimen from White's Creek with BB visible as small points beyond the column facet.
16. Smaller specimen from the same locality; BB much larger.
17. Distal face of IBr, showing articular marking. × 2.
18. Distal face of two IIBr, showing articular marking. × 2.

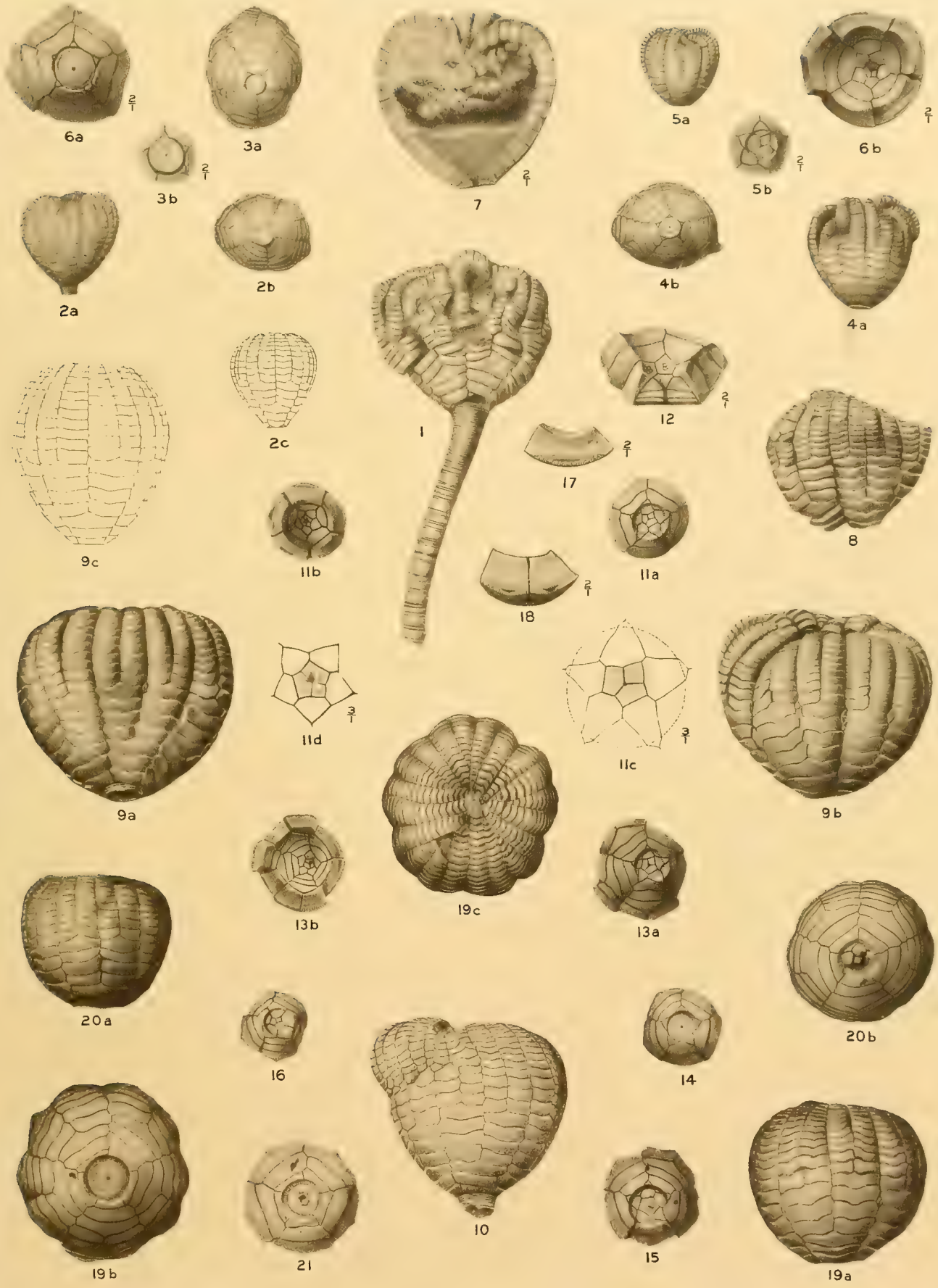
New Providence shales; Lower Carboniferous. Indiana, Kentucky and Tennessee.

Figs. 19-21. **Metichthyocrinus tiaraeformis** (Troost) Hall..... 325

FIG. 19*a*. The type; a perfect, undistorted crown of maximum size, showing the true form and proportions; lateral view. Troost collection; U. S. National Museum. White's Creek, Tennessee.
19*b*. Basal view of same; showing BB entirely hidden within column facet.
19*c*. Distal view of same; showing full length of infolded arms, not branching beyond IIIBr.
20*a*, *b*. Lateral and basal views of a smaller specimen from same locality. BB entirely within column facet.
21. Base of a large specimen from same locality; BB entirely within column facet.

New Providence shales; Lower Carboniferous. Tennessee.

All specimens except those of figures 8 and 19 are in the author's collection.


6a
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7
5a
6b
3b
5b
2a
2b
4b
4a
1
2c
12
17
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9c
11b
11a
18
9a
11d
11c
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19c
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20a
20b
16
14
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19b
21
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19a

PLATE XL

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-3. **Euryocrinus barrisi** n. sp. 316

FIG. 1*a*. Calyx with two rays preserved to the axillary, showing 2 and 3 IBr, and a single small iBr, right anterior view; specimen water-worn and angles somewhat rounded. Author's collection. Alpena, Michigan.

1*b*. Anterior view of same.

1*c*. Posterior view of same, showing anal plates.

1*d*. Basal view, with IBB entirely within column facet.

1*e*. Cross sectional diagram of base, showing relation of the plates; IBB within ring of BB, entirely covered by the column. × $\frac{3}{2}$.

2*a*. Calyx of smaller specimen, with 3 IBr all around, right anterior view. The sharp, angular back of the rays well preserved. Same locality and collection.

2*b, c*. Left posterior and basal views of same.

3. A more mature specimen somewhat flattened, with arms and stem, right anterior view; shows an increase of iBr due to greater age. Author's collection. New Buffalo, Iowa.

Hamilton Gr.; Middle Devonian. Iowa and Michigan.

Figs. 4, 5. **Euryocrinus concavus** Phillips. 317

FIG. 4*a*. The principal type specimen, original of Phillips, pl. 4, fig. 15; being a crown minus arms. Basal view, showing anal series, and the very narrow iBr; IBB almost entirely resorbed. Two of the BB are concealed by a fragment of upper stem ossicle, giving an appearance of only 4 BB. British Museum, No. E6984.

4*b*. Interior view of same specimen, showing remnants of IBB at left side, which are concealed by the columnal in the exterior view.

5. Cotype; original of Phillips, fig. 14, a specimen with rays broken off at $IIBr_2$. Basal view, showing the narrow iBr, and space for a wider anal series of plates, which are lost. British Museum, No. E6983.

Lower Carboniferous. Yorkshire, England.

Figs. 6*a-c*. **Euryocrinus tennesseensis** n. sp. 318

FIG. 6*a*. The type; a much flattened crown, right anterior view. Author's collection.

6*b*. Left posterior view of same.

6*c*. Basal view, showing BB almost covered by column.

New Providence shales; Lower Carboniferous. White's Creek, Tennessee.

Figs. 7*a, b*. **Euryocrinus rofei** Bather and Gregory (MS.). 319

FIG. 7*a*. Posterior view of type; a specimen with rays preserved only to first axillary. British Museum, No. E7423.

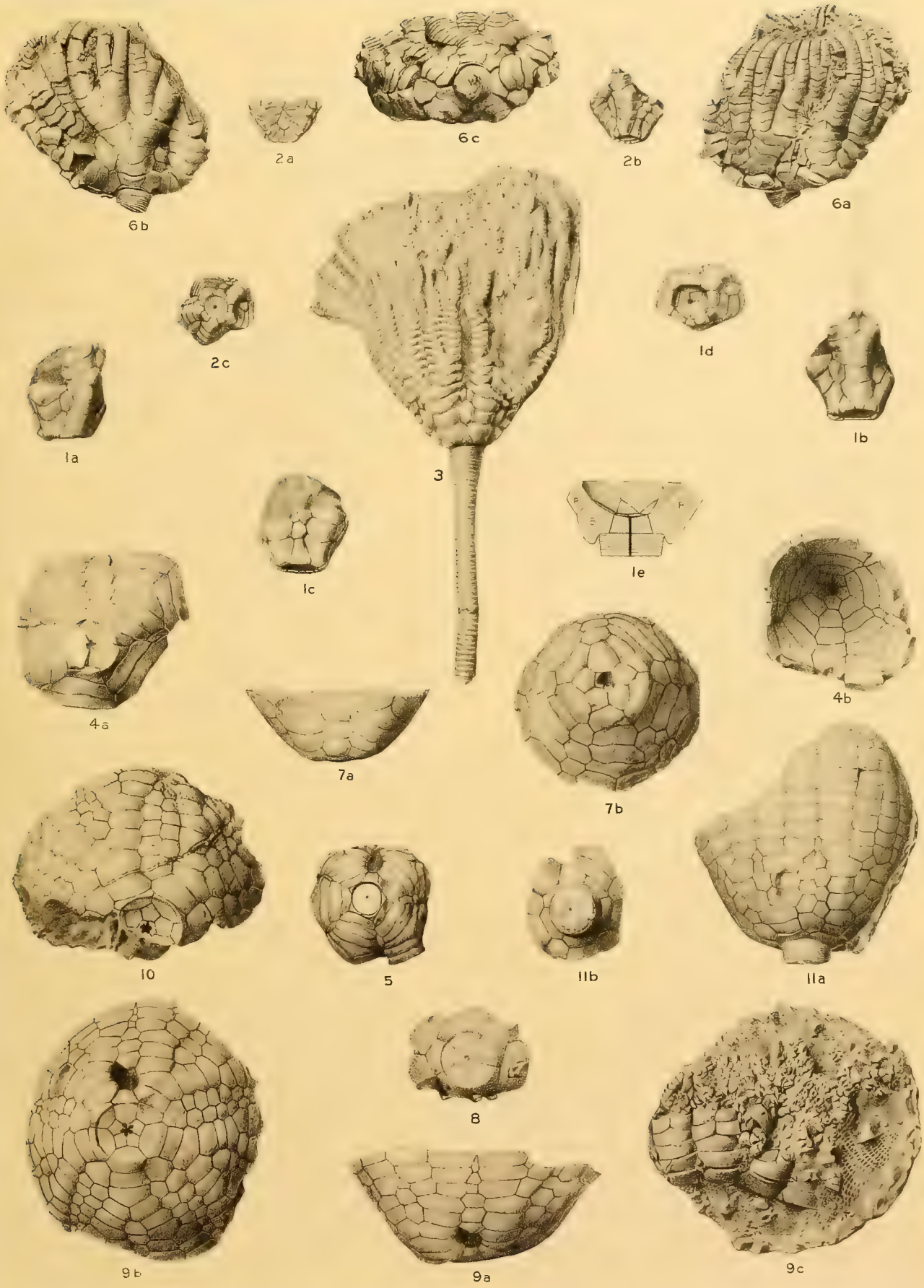
7*b*. Basal view of same, showing the large BB, and iBr plates, with IBB partly resorbed.

Lower Carboniferous. Clitheroe, England.

Fig. 8. (?) **Euryocrinus granulosus** (Phillips). 319

FIG. 8. Basal view of the type and only known specimen; a fragment with only the base and radial plates preserved; IBB not resorbed. British Museum, No. E6982.

Lower Carboniferous. Yorkshire, England.



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Figs. 9-11. **Amphicrinus scoticus** n. sp..... 338

FIG. 9*a*. A mature specimen, vertically crushed. Posterior view, showing rays to about IIIBr$_2$, and the single anal series. British Museum, No. E7422. Roscobie, England.

9*b*. Basal view of same; IBB entirely resorbed, and axial opening cutting the faces of BB in radial position. Shows the single anal and double interbrachial series, with large column facet covering BB and part of RR. Space for first anal plate vacant.

9*c*. Distal view of same, showing character of the arms.

10. Another mature specimen from same locality, with only part of crown preserved; IBB only partly resorbed. Drawn with left anterior interradius at top. British Museum, No. E 640.

11*a*. A nearly complete crown, showing the closely abutting arms; from right anterior interradius. Collection Robert Dunlap. Lesmahagow, Scotland.

11*b*. Base of same, showing RR partly covered by column; anal plate broken out. Hurlet limestone; top of Lower Carboniferous. Scotland.

PLATE XLI

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-2. **Dactylocrinus oligoptilus** (Pacht) 310

FIG. 1*a*. The principal type specimen, left posterior view; after Pacht, pl. 1, fig. 1. Shows the anal structures, equal ray divisions and small ramules on every third or fourth Br. Location of specimen unknown. Costijetsi, bank of river Schelon.

1*b*. Base of same, showing concavity with some proximal columnals attached, entirely covering IBB.

1*c*. Diagram of calyx; after Pacht.

1*d*. Cross-section of base, showing depth of concavity, and position of IBB and BB; after Pacht, pl. 1, fig. 2, slightly corrected. $\times \frac{3}{2}$.

1*e*. Central opening at inner floor of base; from Pacht's fig. 2, showing IBB, and triangular funnel leading to axial opening. $\times \frac{3}{2}$.

2. An axillary IBr, from a smaller cotype, to show surface ornament. $\times 2$. Same locality. Upper Devonian. Pskow, Russia.

Figs. 3-4. **Dactylocrinus beyrichi** (Dewalque in Fraipont) 311

FIG. 3. The type, anterior view; after Fraipont. Ray divisions equal; the figure erroneously represents a ramule on every brachial. University of Liege.

4*a*. Larger specimen from same locality, left anterior view. Shows the arm structure in detail, with ramules from every second brachial; and the sharply concave base with a few tapering columnals resting in it. Author's collection.

4*b*. Posterior view of same, showing anal structures. Upper Devonian. Senzielles, Belgium.

Figs. 5-6. **Dactylocrinus excavatus** (Schultze) 308

FIG. 5*a*. The type, original of Schultze, pl. 7, fig. 2; anterior view. Has no interbrachials. Mus. Comp. Zool. Kerpen, Germany.

5*b*. Posterior view of same, showing post B and some small anal plates; ramules at intervals of 3 or 4; no iBr.

5*c*. Basal view of same, showing deep cavity, involving part of RR. It is 12 mm. deep from level of the curved edge.

5*d*. Diagrammatic cross-section, to show the depth of basal cavity, with IBB at level of $IIBr_2$; and the relative position of BB and RR. $\times \frac{5}{3}$.

6*a*. Specimen with interbrachials; type of Schultze's var. *interscapularis*, pl. 7, fig. 3; r. post. interradial view. Mus. Comp. Zool. Steinfeld, Eifel, Germany.

6*b*. Posterior view of same.

6*c*. Basal view of same, showing deep cavity. Middle Devonian. Eifel Mountains, Germany.

Figs. 7-9. **Dactylocrinus concavus** (Rowley) 309

FIG. 7*a*. The principal type specimen, original of Rowley's *Aristocrinus concavus;* r. post. interradial view; showing large iBr, smaller size of inner ramus, and ramules at intervals of about 3. Coll. Prof. R. R. Rowley.

7*b*. Posterior view of same, showing arrangement of anal plates.

7*c*. Basal view, showing broadly rounded cavity, with IBB hidden by columnals; axial canal radial.

8*a, b, c*. Anterior, posterior and basal views of smaller cotype; a much younger specimen, with ramules less developed. Coll. Prof. R. R. Rowley.

9. Mature specimen with all anal plates intact; posterior view. Author's collection. Hamilton Gr.; Middle Devonian. Calloway County, Missouri.

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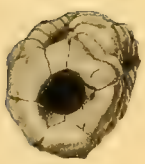
5b

6b

1a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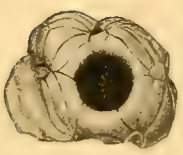
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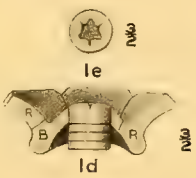

1d

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9

1c

7a

8c

1b

7c

10b

8a

11

8b

10a

PAGE
Figs. 10. **Dactylocrinus alpena** n. sp. 312

Fig. 10*a*. A flattened water-worn crown, with base broken off below radials; anterior view. Shows large ramules at intervals of about 4, and strong lateral buttresses on brachials. Author's collection.

10*b*. Posterior view of same, showing narrow post. B, and space for anal plates—enlarged by distortion of the rays.

Hamilton Gr.; Middle Devonian. Alpena, Michigan.

Fig. 11. **Dactylocrinus tardus** (Hall) 313

Fig. 11. Type of Hall's *Forbesiocrinus lobatus* var. *tardus;* posterior view. Shows post. B and space for anal plates; sharp basal cavity filled by tapering columnals; large ramules at intervals of 6 or 7. New York State Museum, Albany.

Waverly Gr.; Lower Carboniferous. Richfield, Ohio.

PLATE XLII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-9. **Synerocrinus incurvus** (Trautschold) 335

(Also on Plate LXXV)

FIG. 1. One of the types, Trautschold, 1867, taf. 4, fig. 4; also 1879, taf. 14, fig. 11; posterior view. After Trautschold's photograph of the original. Natural size. Mineralogical Museum, Breslau, Germany.

2a. Cotype, 1867, fig. 5; smaller specimen, posterior view. After Trautschold. Same collection.

2b. Basal view of same; after Trautschold. Shows IBB entirely covered by column.

3. A very mature specimen, anterior view; some calyx plates restored as indicated by dotted lines; ant. ray slightly malformed. This specimen shows the strong development of iBr, extending not only to the third bifurcation but between the bases of ramules and the main trunks of the rays. Author's collection.

4a. Adult specimen, left anterior view, showing iBr only to the second bifurcation; base of l. post. ray restored. Author's collection.

4b. Basal view of same, showing relative size of BB and IBB; drawn with l. ant. ray up. IBB entirely within the ring of BB.

5a. Smaller specimen, posterior view; a small iBr between IIIBr. Shows the truncate post. B, and space occupied by first anal plate. Author's collection.

5b. Ventral side of VIIBr of same specimen, showing perisome and the grooves covered by it. × 2.

6a. Young specimen with iBr extending only to IIBr; l. post. view; plates of anal tube *in situ;* first anal plate united to IBr at the right. Author's collection.

6b. Distal view of same, showing infolded arms nearly to the end.

7. Sketch of anal structures, showing the limits of sutural union of first anal plate, perisome omitted; constructed from original of figs. 5, 6, 8.

8a. A dissected specimen with oral plates and tegmen partly preserved. Shows the posterior oral; calcareous integument; articular and sutural surfaces of calyx plates with deep fossae on many. Right posterior interradial view of calyx, and proximal part of stem, with r. post. and r. ant. rays removed; showing articulations on distal faces of BB and lateral faces of ant. R and IBr, and post. B; also the sutural connection of first anal plate with post. B and lower half of l. post. R. × 2. Author's collection.

8b. Right sutural margin of r. post. R and IBr. × 2.

8c. Distal articular face of r. post. IBr_1, showing thickening toward the anal area where first anal plate was attached. × 2.

8d. Left sutural margin of r. ant. R and IBr_1 and $_2$. × 2.

8e. Distal face of r. ant. IBr_2 (axillary) and adjoining iBr. × 2.

8f. Left sutural margin of $IIBr_2$ and $_3$. × 2.

8g. Proximal face of l. post. iBr, second range. × 2.

8h. Lateral face of iBr in second range. × 2.

8i. Distal face of IVBr. × 2.

8k, l. Proximal and distal faces of VIBrs. × 2.

8m. Ventral side of IVBr, showing calcareous integument. × 2.

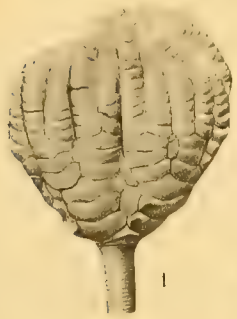
8n. Ventral view of calyx of same specimen, with r. post. and r. ant. plates replaced. Shows the large posterior oral perforated like a madrepore, and two smaller ones; and the space occupied by first anal plate, with sutural connection as shown in fig. 8*a*, and also for nearly full length of r. post. IBr_1. × 2.

8o. Detail of posterior oral, photographically enlarged to show the pores. × 8.

9. Distal portion of arms of a mature specimen much more flattened than in others; perhaps a different species. Author's collection.

Kalkbruche. Upper part of Lower Carboniferous.

All the specimens are from a single locality near Moscow, Russia, associated with *Cromyocrinus, Eupachyocrinus, Phialocrinus, Stemmatocrinus,* etc. The fauna is comparable to that of the Kaskaskia in America, and to that of the Hurlet limestone in Scotland.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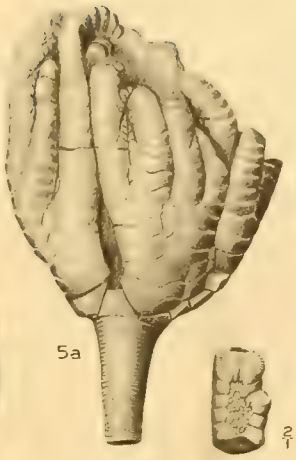
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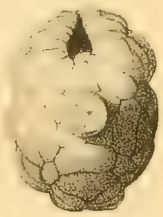
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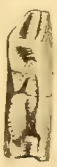
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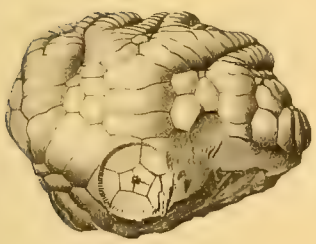
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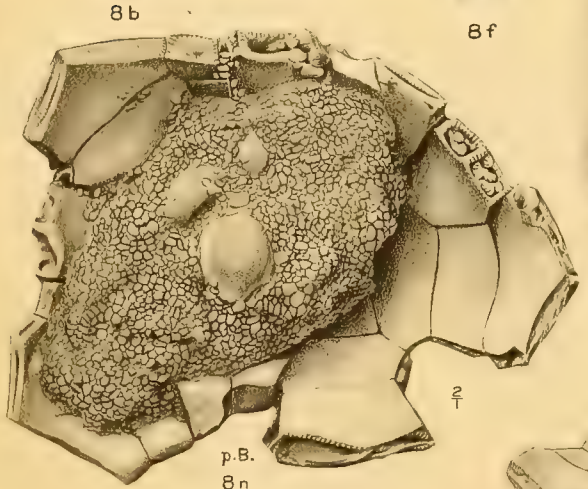
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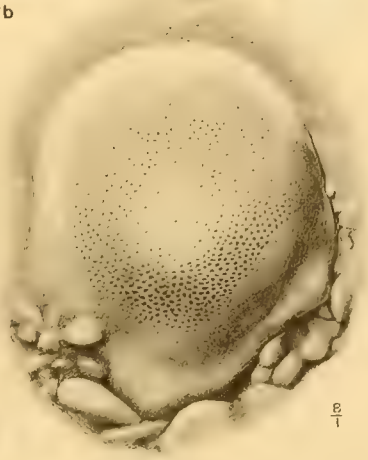
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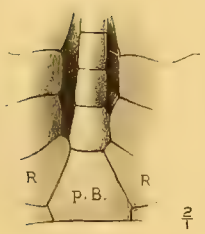
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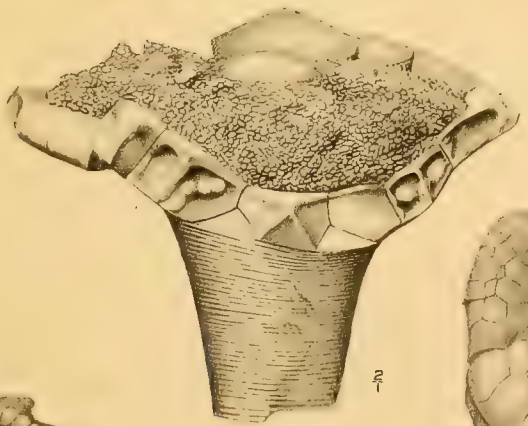
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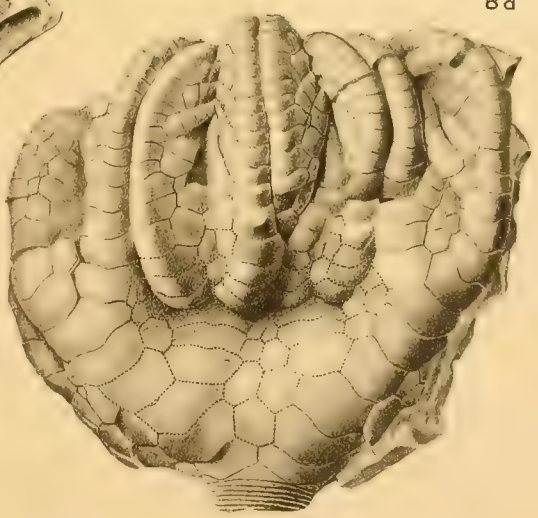
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6b

PLATE XLIII

(All figures on this plate are natural size)

PAGE

Figs. 1-10. **Wachsmuthicrinus thiemei** (Hall) 329

FIG. 1*a*. The type; a very perfect mature specimen, slightly flattened; has arms interlocking for several plates above RR, ramule on about every 5th to 3rd brachial; rays strongly angular. BB visible beyond column. Mus. Comp. Zool.

1*b*. Basal view of same, showing non-differentiation of BB.

2*a*. Similar specimen, with rays interlocking above RR.

2*b*. Basal view of same; BB visible as small points beyond the column.

3. Basal view of large specimen, with regular iBr resting on shoulders of RR, and two of them touching BB.

4, 5. Lateral view of two smaller specimens having iBr.

6, 7. Basal views of smaller specimens with iBr; showing BB larger and about equal all around, and IBB within the column facet.

8. Medium specimen similar to the type, with nearly complete stem, and no iBr.

9. Young specimen with stem, having iBr, and unusually long intervals between ramules.

10. Diagrammatic cross-section of base; showing IBB with slight flange extending a short distance under BB, but not to edge of column facet. This is the greatest extension of IBB found in the family Ichthyocrinidae.

Lower Burlington limestone; Lower Carboniferous. Burlington, Iowa.

Figs. 11-16. **Wachsmuthicrinus spinosulus** (Miller and Gurley) 328

FIG. 11*a*. The type; a very mature and well-marked specimen, much flattened. Has nodes and transverse ridges strongly developed; arms interlocking to above IIBr; ramules about every third Br. Large stem, covering BB and IBB. University of Chicago.

11*b*. Outline restoration, showing normal contour of crown.

12. Base of similar specimen, with spiniferous nodes on RR. BB entirely concealed by column.

13*a*. Very young specimen, with relatively broad base and large RR; but basals nevertheless hidden by column.

13*b*. Opposite view, showing arms infolding at IIIBr.

14. Mature flattened specimen from Lincoln County, Kentucky, with only obscure nodes. Note the interlocking of Br to above second bifurcation.

15. Flattened specimen, with arms diverging on first brachial above axillaries; large ramules at long intervals.

16. Smaller specimen, showing tendency to similar divergence of rays.

New Providence shales (Knobstone); Lower Carboniferous. Clark County, Indiana; Bullit and Lincoln counties, Kentucky.

All specimens figured on this plate, except the two types, are in the author's collection.

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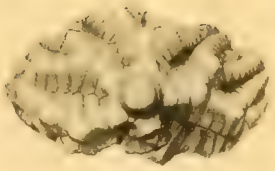
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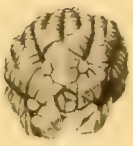
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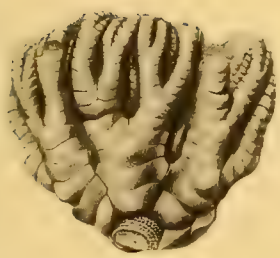
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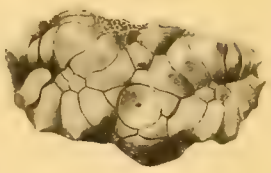
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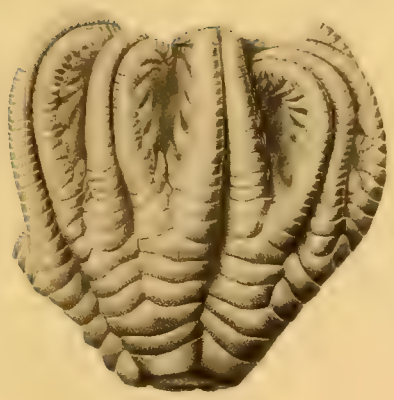
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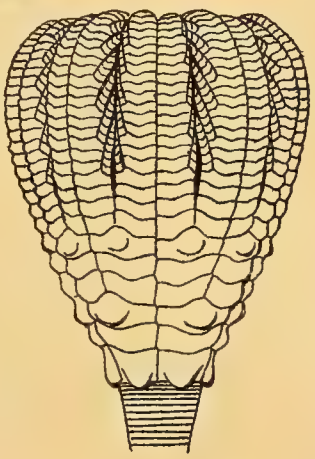
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11a

PLATE XLIV

(All figures on this plate except 9*c* are natural size)

PAGE

Figs. 1-5. **Wachsmuthicrinus spinifer** (Hall) 331

FIG. 1*a*. A nearly perfect mature specimen with stem attached. Has large iBr and iIIBr; spines on axillary IBr; ramules, after first two or three, on every second brachial. Original of Meek and Worthen, Geol. Surv. Ill., V, pl. 4, fig. 1. Mus. Comp. Zool.

1*b*. Basal view of same, showing IBB entirely within ring of non-differentiated BB.

2. Broken specimen, with part of rays well preserved, showing extreme size of spine on axillary IBr. Author's collection.

3. Very young specimen, with iBr and large spines. Author's collection.

4. Base of broken specimen from Lake Valley, New Mexico; one ray showing axillary spine. Author's collection.

5. Isolated axillary plates, from Kinderhook beds at Fern Glen, Missouri, showing existence of a similar species there. Author's collection.

Lower Burlington limestone; Lower Carboniferous. Burlington, Iowa, except as otherwise stated.

Figs. 6-7. **Wachsmuthicrinus bernhardinae** n. sp. 332

FIG. 6. A very mature specimen, with numerous iBr and iIIBr passing into perisome; very small spines on axillaries; ramules mostly on every second brachial. Author's collection.

7*a*. Lateral view of isolated base and RR of another specimen; showing normal shape of RR and the deep patelloid sockets. Author's collection.

7*b*. Basal view of same, showing proportions of BB and RR; IBB covered by top columnal.

7*c*. Interior view, showing IBB; the semi-circular marks represent indentations on the inner surface, rather fainter than the drawing shows.

Lower Burlington limestone; Lower Carboniferous. Burlington, Iowa.

Fig. 8. **Wachsmuthicrinus iowensis** n. sp. 333

FIG. 8. Oblique basal view of crushed specimen; showing very large first iBr, and widely divergent rays. Author's collection.

Upper Burlington limestone; Lower Carboniferous. Burlington, Iowa.

Fig. 9. **Wachsmuthicrinus ponderosus** n. sp. 333

FIG. 9*a*. A large specimen perhaps of this genus; with lower part of crown broken away. British Museum, No. 75696.

9*b*. Outline of plates of opposite side, from impressions of suture lines on the internal cast.

9*c*. Detail of surface marking on unworn part of a higher brachial.

Lower Carboniferous. Sedbury, England.

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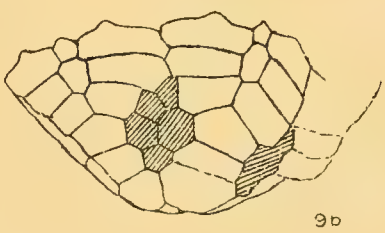
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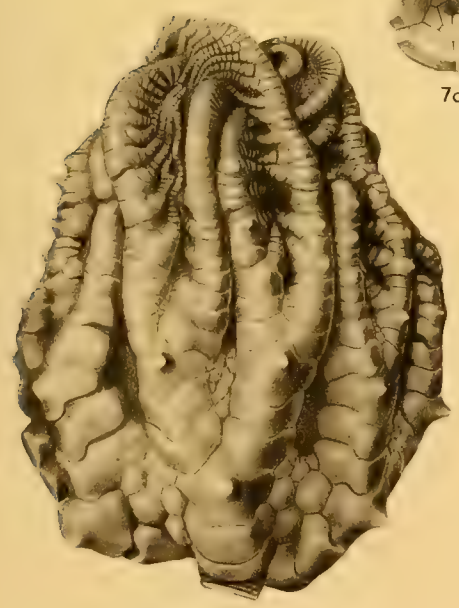
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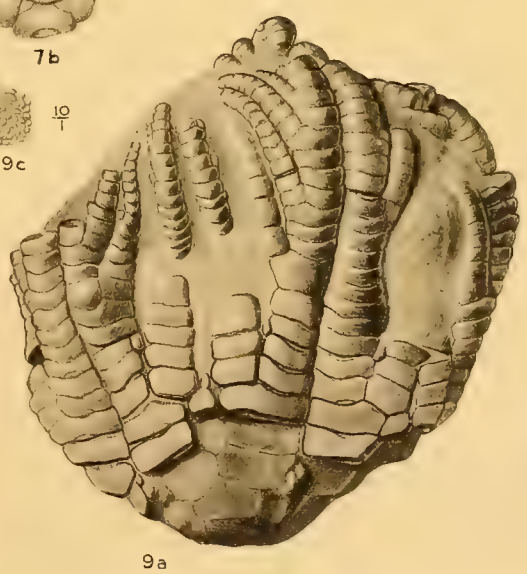
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PLATE XLV

(All figures natural size except where otherwise stated)

PAGE

Fig. 1. **Protaxocrinus elegans** (Billings) 346

FIG. 1. The type, original of Billings, Decade IV, pl. 4, fig. 4*a;* a flattened specimen, from anterior side. Shows stem with slightly alternating columnals; angularity of lower brachials; and peculiar flattening of distal ends of arms in upper part. Mus. Geological Survey of Canada.

Trenton limestone; Ordovician. Ottawa, Canada.

Figs. 2-7. **Protaxocrinus laevis** (Billings) 348

FIG. 2. The type, original of Decade IV, pl. 4, fig. 3*a;* anterior view. Mus. Geological Survey of Canada.

3*a*. Specimen from Ottawa with fewer interbrachials, anterior view; has mostly 4 IIBr (3 in one ray). Author's collection.

3*b*. Posterior side of same much distorted, showing large plates of the anal series resting in a socket on post. B.

4*a, b*. Anterior and enlarged posterior view of a fine specimen from Kirkfield, Ontario, showing the anal structures perfectly. It has mostly 5 IIBr (4 in 2 rays), and rather the proportions of *P. elegans;* but the arms are smoothly rounded. RA in form of a radial under r. post. ray; anal series resting in socket on right shoulder of post. B. Fig. 4*b*, × 2. Author's collection.

5*a, b*. Small specimen from Ottawa, with 3 to 4 IIBr, showing anal plates; anterior and posterior views. × 2. Geological Survey of Canada.

6*a, b*. Similar specimen from Kirkfield, with 4 and 5 IIBr. × 2. Author's collection.

7. Anterior view of characteristic specimen from Ottawa, with stem attached. Author's collection.

Trenton limestone; Ordovician. Canada.

Fig. 8. **Protaxocrinus girardeau** n. sp. 349

FIG. 8. A specimen from near Thebes, Southern Illinois, of Richmond age; Silurian. A recurrent form scarcely distinguishable from the Trenton species. Author's collection.

Figs. 9-11. **Protaxocrinus robustus** n. sp. 349

FIG. 9*a*. The principal type specimen, from anterior radius. Author's collection.

9*b*. Posterior view of same; showing very large anal plate not attached at either side, and heavy arms, two of which do not branch so far as seen. × 2.

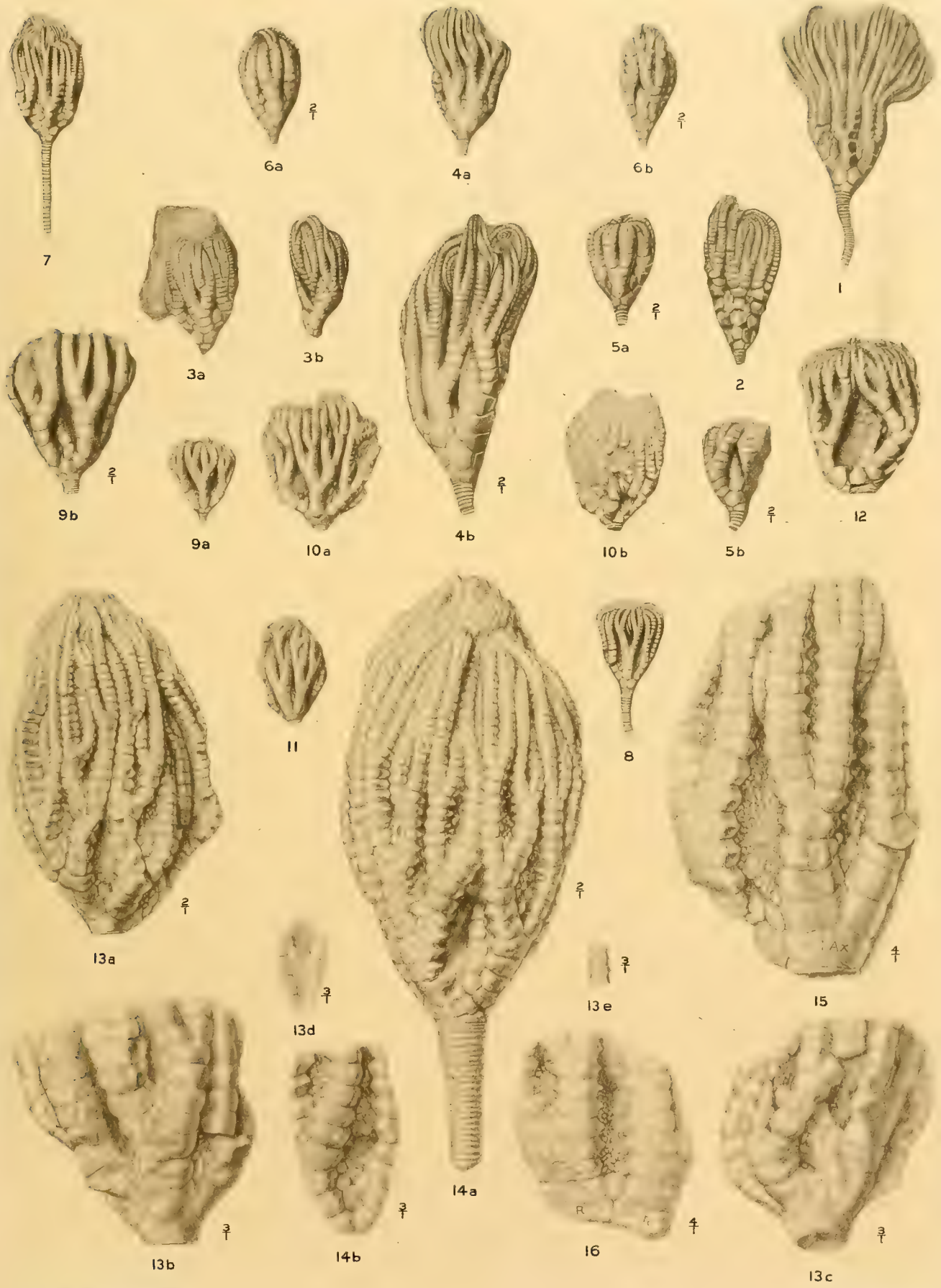
10*a, b;* 11. Anterior and posterior views, and anterior view, respectively, of two other specimens from same locality; showing presence of 3 IIBr, correlating with the short robust crown of this species. Author's collection.

Brownsport limestone; Niagaran. Decatur County, Tennessee.

Fig. 12. **Protaxocrinus virginiensis** n. sp. 350

FIG. 12. Posterior view of the only specimen; having a very wide anal area, 3 IIBr, with much slenderer and more tapering arms than the last species. Author's collection.

Helderbergian; Devonian. Keyser, West Virginia.



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Heliotype Co. Boston.

PAGE
Figs. 13-16. **Protaxocrinus interbrachiatus** (Angelin) 350

FIG. 13*a*. One of the type specimens, original of Angelin, pl. 20, fig. 9, and partly of 10; l. post. interradial view. × 2. Riks Museum. Follingbo.

13*b*. Anterior view of lower part, showing interbrachial structures. × 3.

13*c*. Posterior view of same; showing RA under r. post. ray, anal series rising from right shoulder of post. B, united for some distance to r. post. ray, and bordered by perisome on the left. × 3.

13*d*. Intersecundibrachs of r. ant. ray. × 3.

13*e*. IVBr, showing ornamentation of the arms. × 3.

14*a*. A fine specimen from Follingbo, in part original of Angelin, pl. 20, 10, posterior view; showing posterior rays and anal structures characteristic of the genus. 2 IBr, and RA in primitive position. Note the angular buttresses at lateral face of brachials as far up as can be seen, in this and the next three figures; these apparent angularities do not indicate that solid plates interlocked with them, for the perisome is actually seen occupying the space next to them, and attached at their inner margin; this is well shown in fig. 16. × 2. Riks Museum.

14*b*. Interbrachials at first and second axils of r. post. ray. × 3.

15. Broken specimen from Follingbo, showing plates of primary and secondary iBr areas, and how the perisome following the single iBr is attached to the inner margin of the brachials; coiled distal ends of arms seen at upper part. × 4. Riks Museum.

16. The same iBr structures in another fragment from same locality. × 4. Riks Museum. Wenlock Gr.; Silurian. Gotland, Sweden.

PLATE XLVI

PAGE

Figs. 1-7. **Protaxocrinus salteri** (Angelin) 352

FIG. 1*a*. The type specimen, original of Angelin, pl. 23, figs. 1, 1*a*; from r. ant. interradius; showing less angularity than in the preceding species of lateral faces of brachials; 3 IIBr. × ⅔. Faro (*d*).

1*b*. Posterior view of lower portion, showing post. B, and beginning of anal series. ×⅔.

2*a*. Another specimen from Faro (*d*), from r. post. radius; has 4 IIBr in half of one ray. ×⅔.

2*b*. Opposite view of same.

2*c*. First interbrachial area, showing plates and perisome. × 3.

2*d*. Intersecundibrach area. × 3.

2*e*. IVBr, ornamented with small nodes. × 3.

3*a*. Abnormal specimen from Djeywick (*c*), posterior view. One IBr lacking in r. post. ray; but there are 4 IIBr in the ray, and the small plate next to BB represents the RA. Type of *Taxocrinus distensus* Angelin, pl. 26, figs. 7, 7*a*. ×⅔.

3*b*. Basal view of same. × ⅔.

4. Abnormal specimen from Follingbo (*f*), from l. post. radius, in which it has but one IBr, compensated by an additional IIBr in each ramus of that ray. × 2.

5*a*, *b*. Type of *Taxocrinus tubuliferus* Angelin, pl. 20, figs. 11, 12; posterior and basal views; a very young specimen probably of this species. × 3. Endre (*d*).

6*a*, *b*. Type of *Taxocrinus austini* Angelin, pl. 19, figs. 11, 11*a*, from Wisby (*d*). A very immature, much distorted specimen, wholly without diagnostic characters for specific description; perhaps of this species; anterior and posterior views. × 3.

6*c*, *d*. The same views of this specimen as restored by Mr. Liljevall. × 3 (enlargement fraction omitted on plate).

7. Specimen from Follingbo (*f*), perhaps a variant of this species, with 4 IIBr in the two ray divisions visible; r. post. view. × 2.

Wenlock Gr.; Silurian. Gotland, Sweden.

All specimens in the Riks Museum, Stockholm.

Figs. 8-11. **Protaxocrinus ovalis** (Angelin) 351

FIG. 8*a*. The type, original of Angelin, pl. 20, fig. 13, anterior view. Has 3-5 IIBr, but rather broad brachials without ornamentation, and lateral faces without prominent buttresses. × 2. Follingbo (*f*).

8*b*. Posterior view of same, showing anal series but little attached at right side. × 3.

9*a*. Broken specimen from Follingbo (*f*), from r. ant. radius; 4 and 5 IIBr, and iBr with perisome following. × 2.

9*b*. Lower part of same. × 4.

10*a*, *b*. R. ant. and posterior views of very young specimen from Sigdes (*d*), perhaps of this species. × 3.

11. Abnormal specimen from Follingbo (*f*) lacking one IBr in r. post. ray. RA distinguishable by its small size. × 2.

Wenlock Gr.; Silurian. Gotland, Sweden.

All specimens in the Riks Museum, Stockholm.

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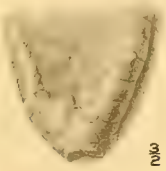
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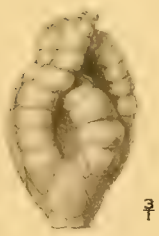
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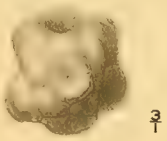
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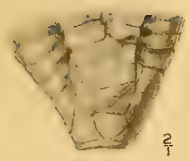
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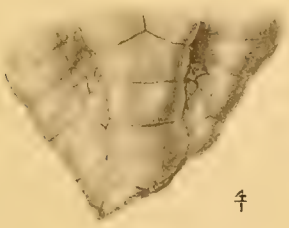
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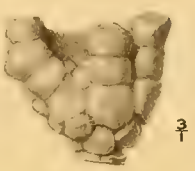
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PLATE XLVII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-6. **Gnorimocrinus expansus** (Angelin) 354

FIG. 1. The type, original of Angelin, pl. 20, fig. 16; posterior view, showing rhombic radianal, and large anal tube resting in socket at right shoulder of post. B. × 3.

2a. Similar specimen, anterior view. × 2.

2b. Same from posterior side. × 3.

2c. Anal structures of same seen from the side, showing small plates of perisome bordering the tube. × 3.

3a. Another specimen from r. ant. interradius. × 2.

3b. Detail of r. ant. interradius, showing perisome. × 4.

4a. The largest specimen, from l. ant. interradius. × 2.

4b. Detail of r. post. interradius, showing perisome. × 4.

5. Specimen with abnormal anal side; very small RA, and tube-plates partly connected with R at left side. × 2.

6. Basal view of abnormal specimen, with RA pentagonal and within ring of BB. × 2.

Wenlock Gr.; Silurian. Gotland, Sweden, Follingbo (*f*).

All specimens in Riks Museum, Stockholm.

Figs. 7-12. **Gnorimocrinus cirrifer** n. sp. 355

FIG. 7. Mature specimen somewhat flattened, with nearly complete stem, and remnants of several whorls of cirri; anterior view.

8. Similar specimen; posterior view, showing anal tube.

9, 10. Posterior and basal views of two small specimens. Fig. 9, × 2. Fig. 10, × 3.

11. Small specimen, with complete stem and branched root; l. post. view.

12. Youngest specimen, with stem complete. × 2.

Brownsport limestone; Niagaran. Decatur County, Tennessee.

All specimens in author's collection.

Figs. 13-17. **Gnorimocrinus varians** n. sp. 356

FIG. 13*a*. Right anterior view of adult injured specimen; showing perisome in iBr areas, and 2 IIBr.

13*b*. Posterior view of same, showing anal tube.

14*a*, *b*. Posterior and basal views of crushed specimen, showing anal tube and strong perisome attached to its right side; 2 and 3 IIBr.

15. Anterior view of large specimen with 3 IIBr.

16. Small specimen, with very large RR.

17. Anterior view of small specimen with stem.

Brownsport limestone; Niagaran. Decatur County, Tennessee.

All the specimens are in the author's collections.

Fig. 18. (?) **Eutaxocrinus perplexus** n. sp. 365

FIG. 18*a*. Anterior view of type, an abnormal specimen; slightly flattened crown, with arms beyond the fourth bifurcation; iBr touching BB. Author's collection.

18*b*. Right posterior view of same, showing the very large anal tube having some lateral connection with adjoining radials; r. post. ray malformed, producing a plate resembling RA, which is probably sporadic.

Middle Devonian. Verviers, Belgium.

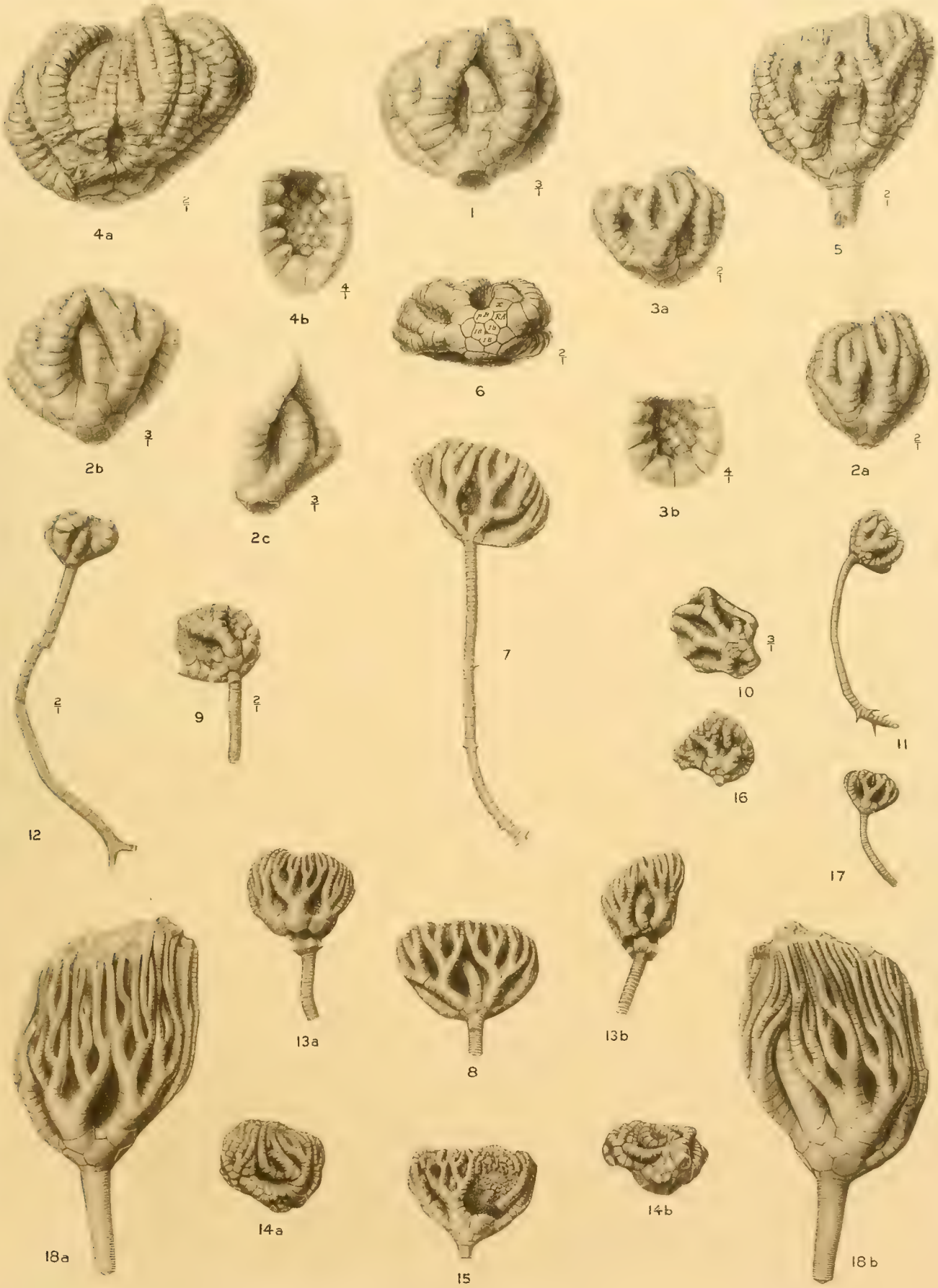

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PLATE XLVIII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-4. **Eutaxocrinus oblongatus** (Angelin) 359

FIG. 1*a*. The type, original of Angelin, pl. 20, fig. 17; a flattened crown with arms complete, having unequal bifurcations almost to the point of heterotomy; from l. post. interradius. × 2. Faro (*d*).

1*b*. The same from r. ant. radius; showing iIIBr. × 2.

1*c*. Posterior view of same; anal series from right shoulder of post. B closely fitting to rays from effect of lateral pressure. × 2.

1*d*. Interbrachial plate in l. ant. interradius. × 2.

2*a*. Type of *Taxocrinus rigens*, Angelin, pl. 18, figs. 7, 8; a crushed specimen; posterior view, showing anal series free at left side. × $\frac{3}{2}$. Wisby (*d*).

2*b*. Lateral view of base, showing space between IBB. × $\frac{3}{2}$.

3*a*. Fragment from Wisby (*d*), laterally compressed, showing post. B with anal series resting on its right shoulder. × 2.

3*b*. Basal view of same; showing notched free space at edges of IBB. × 2.

4. Fragment of small crushed specimen from Wisby (*d*), r. post. view; showing anal series partly detached from rays by pressure. × 3.

Wenlock Gr.; Silurian. Gotland, Sweden.

All specimens in the Riks Museum, Stockholm.

Figs. 5-10. **Eutaxocrinus rhenanus** (Roemer) 360

FIG. 5*a*. Roemer's figure of the type, after Roemer, pl. 2, fig. 1; restored in distal portion of arms (see fig. 6); shows 4 IIBr and heavy arms. Slightly enlarged.

5*b, c, d, e*. Columnals and brachials in the order indicated; to show crenulations and tubercular surface ornament. × 2.

6. Cast of the type; from the original natural mould in University of Bonn.

7. A smaller specimen from a similar natural mould; shows an irregular small iBr in one area. Author's collection.

8. A specimen figured by Sandberger; copied from Verstein. Nassau, pl. 35, fig. 17*a*.

9. Another specimen with stem, after Sandberger, pl. 35, fig. 17. Probably near natural size.

10. Copy of Sandberger's text figure, p. 393, of another specimen under this name, but clearly not of this species.

Lower Devonian. Coblentz, Germany.

Figs. 11-12. **Eutaxocrinus stürtzii** (Follmann) 361

FIG. 11. Copy of the type figure, after Follmann, pl. 1, fig. 3; showing narrowness and great length of arms; calyx plates disarranged. University of Bonn.

12. A specimen in the author's collection, with plates in good order.

Hunsrücker slates; Lower Devonian. Bundenbach, Germany.

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PLATE XLIX

PAGE

Figs. 1-7. **Eutaxocrinus whiteavesi** n. sp..... 366

FIG. 1*a*. Posterior view of type, flattened; showing lower part of anal tube displaced and pushed against r. post. ray; 3 IIBr. Author's collection.

1*b*. Lower part of same, enlarged; showing form of posterior basal, and the flange-like curved edges of brachial plates. IBB not visible in side view. × 2.

2. A cotype, a well preserved specimen, considerably flattened; showing the arms complete, and flanged margins of brachials. Author's collection.

3. Posterior view of smaller cotype, having remnants of anal structures. × 2. Author's collection.

4. Flattened specimen with column attached, and 4 IIBr; another cotype. U. S. National Museum.

5*a*. Anterior view of abnormal specimen, in the University of Toronto.

5*b*. Anal side of lower part, showing irregular plates at either side of posterior basal. × 2.

6. Abnormal specimen, with one IBr in l. post. ray, and none in r. post. ray—the bifurcation being directly on the radial. The base is apparently undivided. Am. Mus. Nat. Hist.

7*a*. Abnormal specimen with only 4 rays; view from l. post. ray, which has only two IBr. Shows well the peculiar turning up of the margins of brachial plates. Author's collection.

7*b*. View from l. ant. interradius, with 2 IBr to the right. × 2.

7*c*. Posterior view, showing wide post. B with anal plates following, and 3 plates to the right of them which are all that is left of the right posterior ray. × 2.

7*d*. Base, showing IBB *in situ*, within limits of column facet. × 2.

7*e*. Diagram of calyx, showing distribution of plates; 5 basals, mostly abnormal in shape; three rays with 1 IBr each, and one with 2.

Hamilton Gr.; Middle Devonian. Thedford, Canada.

Fig. 8. **Eutaxocrinus gracilis** (Meek and Worthen)..... 367

FIGS. 8, 8*b*. Opposite views of the type and only known specimen; abnormal and much injured. University of Illinois.

Hamilton Gr. Jackson County, Illinois.

Figs. 9-10. **Eutaxocrinus affinis** (Müller)..... 362

FIG. 9*a*. The type, after Müller, Abhandl., 1857, pl. 1, figs. 1, 2; anterior view. Museum Anat. u. Min. Berlin.

9*b*. Posterior view of same.

10*a*. Original of Schultze, pl. 4, figs. 2*a*, *b*, a somewhat flattened and vertically compressed specimen; anterior view, showing the large, thick iBr, broad rays, and 4 IIBr. IBB visible below BB. Mus. Comp. Zool.

10*b*. Posterior view of same, after additional cleaning; showing more long anal tube-plates than appear in Schultze's figure.

10*c*. Basal view of same, showing the stout iBr plates.

Middle Devonian. Kerpen, Eifel, Germany.

Figs. 11-12. **Eutaxocrinus juglandiformis** (Schultze)..... 363

FIG. 11*a*. One of the types, original of Schultze, pl. 4, figs. 4, 4*a*; anterior view; a very rotund specimen, somewhat crushed vertically. An arm fragment of some other crinoid is lodged in iBr area. Mus. Comp. Zool.

11*b*. Posterior view of same; r. post. ray broken away, and the remains of a broad anal tube with very short plates are seen toward the left.

11*c*. Basal view of same, showing IBB slightly smaller than basal ring but not enclosed within it. No iBr; perisome visible in one interradius. Anterior side up.

12. Cotype, original of Schultze, pl. 4, fig. 4*b*; r. post. radial and partly basal view. Shows large BB; numerous small perisome plates in 3 interradii; and the large anal tube in place to the left, resembling an arm. Author's collection.

Middle Devonian. Gerolstein, Eifel, Germany.

Fig. 13. **Eutaxocrinus eifelensis** n. sp..... 368

FIG. 13. Lateral view of type; a complete crown with long stem. Author's collection.

Middle Devonian. Pelm, Eifel, Germany.

7b

6

7e

1a

7c

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7d

1b

13

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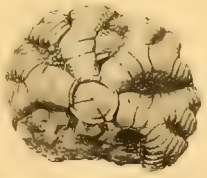
5b

5a

8b

11a


11c

11b

12

10a

9a

10c

9b

10b

PLATE L

(All figures on this plate are natural size)

PAGE

Figs. 1, 3. **Eutaxocrinus ithacensis** (Williams) 367

FIG. 1. The principal type specimen; a mature, flattened crown with nearly complete stem, and root encrusting upon a large Spirifer; anterior view. This root was separated from the stem in collecting, but they were found together, along with a number of other stems of this species, and the root undoubtedly belongs either to this specimen, or to another one close beside it in the colony. Cornell University, Ithaca, New York.

3. Younger specimen; irregular in having a single IBr in one ray. Author's collection.
Portage Gr.; Upper Devonian. Ithaca, New York.

Figs. 2, 4, 5. **Eutaxocrinus alpha** (Williams) 368

FIGS. 2, 4. Supposed types of *Taxocrinus ithacensis* var. *alpha* Williams, in Cornell University Museum; 2 is anterior view; 4 is left posterior, and shows the posterior basal. The specimens are in form of natural moulds. Ithaca, New York.

5. A very young specimen with stem nearly complete; showing juvenile character in the elongate, barrel-shaped distal columnals; natural mould. New York State Museum, Albany. Avoca, New York.
Chemung Gr.; Upper Devonian. New York.

Figs. 6-9. **Eutaxocrinus curtus** (Williams) 369

FIG. 6. The type; cast from a natural mould, as preserved in Cornell University Museum; arms with very slender branches distally. It is a young specimen, with but two or three thin columnals next to the calyx; the apparent prongs toward the distal end do not belong to this stem. Ithaca, New York.

7. Another young specimen, perhaps of this species, with alternating columnals next to calyx. Same locality. Author's collection.

8. Mature individual with well-developed stem, somewhat flattened distally; cast from natural mould. New York State Museum, Albany. Avoca, New York.

9. Crown of similar specimen in same collection, posterior view; anal area compressed, and tube plates clinging to r. post. ray. Same locality.
Chemung Gr.; Upper Devonian. New York.

Fig. 10. (?) **Eutaxocrinus amplus** n. sp. 370

FIG. 10. The type; cast from a natural mould. University of Chicago.
Chemung Gr.; Upper Devonian. Binghamton, New York.

Figs. 11-19. **Eutaxocrinus fletcheri** (Worthen) 371

FIG. 11. Worthen's type; a rather small specimen somewhat injured. University of Illinois.

12. A mature, slightly compressed crown, original of W. and Sp., Geol. Surv. Ill., VIII, pl. 15, fig. 6; with nearly complete stem, unshaded part being restored from another specimen. Anterior view; showing iBr in 3 axils. Author's collection.

13. Another mature crown, slightly flattened; posterior view, showing anal tube passing into perisome. Author's collection.

14. Mature crown, with almost natural contour; r. post. radial view, showing same structures as last, also iBr, iIIBr, and iIIIBr. Author's collection.

15. Large flattened crown, l. post. view; showing perisome at right of anal tube, and form of post. B. Author's collection.

16. Smaller crown, flattened; r. ant. view, showing iBr plates. Author's collection.

17. Anterior view of smaller flattened specimen, with one primary iBr, and none in the higher axils. Author's collection.

18. Base of another specimen; showing IBB in place, nearly equal in size. Author's collection.

19. Another base, with IBB removed, showing the space occupied by them, and the size of their inner surface. Author's collection.
Kinderhook Gr.; Lower Carboniferous. LeGrand, Iowa.

Fig. 20. **Eutaxocrinus montanensis** n. sp. 372

FIG. 20. Posterior view of specimen from nearly equivalent strata near Elder, Montana. U. S. National Museum.

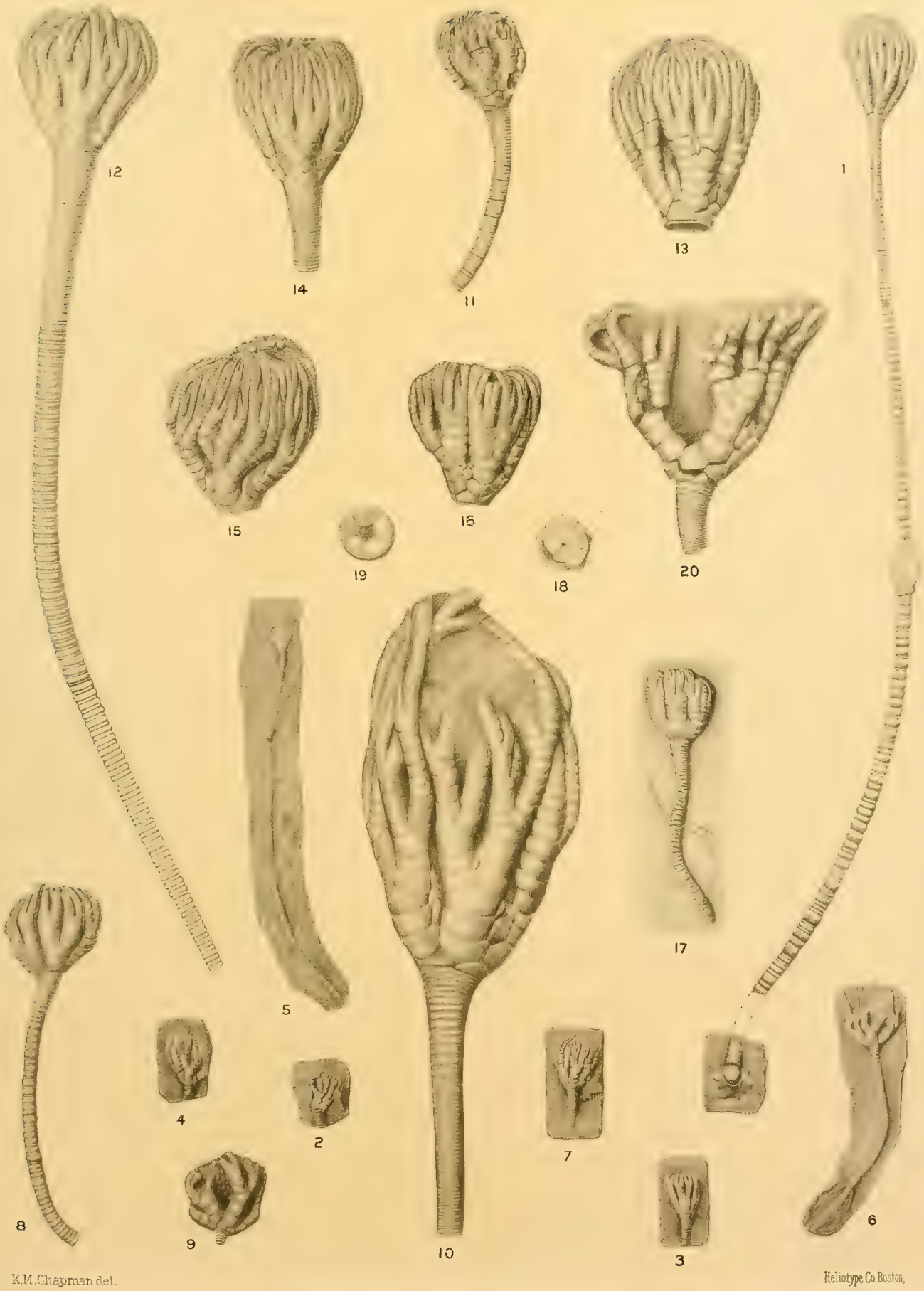


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PLATE LI

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-4. **Taxocrinus macrodactylus** (Phillips)..... 383

FIG. 1. The principal type specimen. After Phillips, Pal. Foss. Cornwall, pl. 15, fig. 41*e*. Base broken, but 3 IBr plainly shown. Pilton, England.

2. The original of fig. 1, in its present condition; Museum of Practical Geology, London. "The only remaining specimen of Phillips's types known, natural size" (Whidborne). After Whidborne, Devonian Fauna, pl. 33, fig. 2.

3. Another of the types, smaller specimen. After Phillips, pl. 15, fig. 41*b*. Evidently drawn from a natural mould in the rock.

4*a*. Specimen from Pilton; stem and base drawn from a natural mould in the rock. After Whidborne, pl. 33, fig. 4. Museum of Practical Geology, London.

4*b*. Wax cast of proximal part of stem and calyx of same specimen, restored above the radials. After Whidborne, pl. 33, fig. 4*a*. × 2 (erroneously noted × 3 on the plate). Pilton beds, Devonian. England.

Fig. 5. **Taxocrinus stultus** Whidborne..... 385

FIG. 5*a*. The type, posterior view. Drawing from a natural mould in the rock; showing stem not enlarging at calyx. After Whidborne, pl. 34, fig. 2. × 2. Porter collection, Pilton, England.

5*b*. Further enlargement of same view of calyx, from a wax cast, showing anal structures. After Whidborne. × 3.

5*c*. Anterior view of same, from wax cast. After Whidborne. × 3.
Pilton beds, Devonian. Pilton, England.

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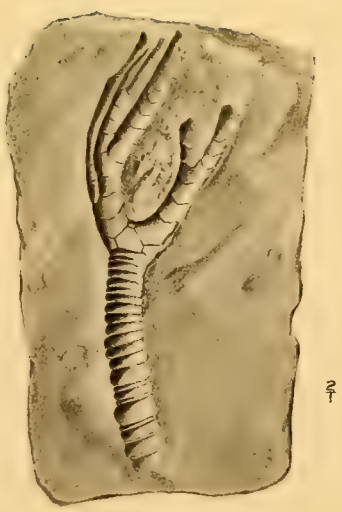

5a

4b

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PLATE LII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-4. **Taxocrinus communis** (Hall) 387

FIG. 1. The type, antero-lateral view; a flattened specimen, showing the rounded calyx, presence of iBr plates, and stem not enlarging at calyx but farther down. New York State Museum, Albany.

2. Left posterior view of smaller specimen; showing in side view the position of the first anal plate. Same collection.

3. Young specimen showing immature characters of stem, with less swelling on receding from calyx. Same collection.

4. A nearly complete specimen, slightly flattened. Shows in full the proximal contraction of the stem, followed by enlargement receding from the calyx (as indicated in the type), and subsequent diminution distally; also the unusual lengthening of the columnals in the swollen part, and at intervals below. Author's collection.

Cuyahoga shales; Lower Carboniferous. Richfield, Ohio.

Fig. 5. **Taxocrinus kelloggi** (Hall) 388

FIG. 5*a*. The type, considerably flattened; anterior view. Showing the usual stem of the genus; wide iBr spaces; and nodes on the axillary brachials. New York State Museum, Albany.

5*b*. Left posterior view of same.

5*c*. Sketch of posterior basal, and anal structures.

Cuyahoga shales; Lower Carboniferous. Richfield, Ohio.

Fig. 6. **Taxocrinus interscapularis** Hall 385

FIG. 6. The type; showing the narrow calyx and rapidly tapering arms. The base is broken off. University of Illinois. New Buffalo, Iowa.

Hamilton Gr.; Middle Devonian. Iowa.

Figs. 7-8. **Taxocrinus telleri** n. sp. 386

FIG. 7*a*. A nearly perfect crown; anterior view. Coll. Mr. E. E. Teller.

7*b*. Posterior view of same, showing anal plates.

8*a*. Abnormal specimen with seven rays; found associated with the last, perhaps a young individual of the same species; anterior view. In this specimen the entire base, both IBB and BB, is fused into a solid disk; the primibrachs are mostly 2; there are 6 perfect radials, and the seventh is vertically divided; 6 rays bifurcate, and the seventh remains single. × 2. Mr. Teller's collection.

8*b*, *c*. Posterior and basal views of same. × 2.

8*d*. Diagram of plates to first axillary. × 2.

Hamilton Gr.; Middle Devonian. Milwaukee, Wisconsin.

Figs. 9-11. **Taxocrinus lobatus** (Hall) 386

FIG. 9. The type, anterior view. The specimen is poorly preserved, is much injured, and does not show the characters distinctly. In three visible rays it has but 2 IBr. Am. Mus. Nat. Hist. Canandaigua Lake, New York.

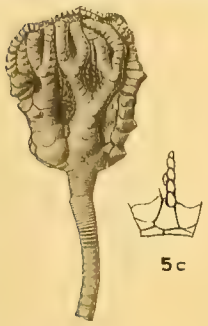
10. Posterior view of a fine specimen from the same locality, showing the perisome and other characters in great perfection. N. Y. State Museum, Albany.

11*a*. Another specimen from the same locality in author's collection, anterior view.

11*b*. Posterior view of same; structures obscured by a gasteropod.

Since the figures and descriptions for this work were printed I have received from Miss Winifred Goldring, of the New York State Museum, a sketch of a fine column belonging to this species, preserved to a length of 20 cm., which will be figured in the forthcoming monograph of the Devonian crinoids of New York, now in preparation by the State Museum. This column has the usual proximal enlargement typical for the genus, but is remarkable for the regularly spaced enlarged nodals at intervals of about 8 columnals; these become less prominent distally until all become substantially equal. No enlargement below the proximal cone.

Hamilton Gr.; Middle Devonian. New York.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8d

8c

8a

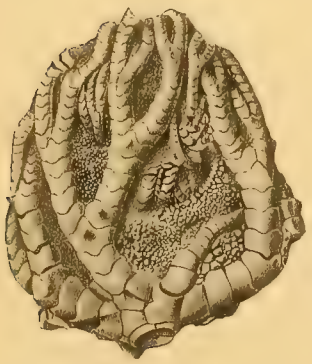
7b

9

6

7a

11b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11a

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PLATE LIII

(All figures, except 1*b*, are natural size)

PAGE

Figs. 1-6. **Taxocrinus intermedius** Wachsmuth and Springer..... 389

FIG. 1*a*. Type specimen, figured with the first published description in 1888; posterior view, showing form of post. B, the anal tube rising from a socket at its right shoulder, and folds in the perisome at the side of the tube. The specimen is not flattened, and shows the natural contour of the calyx.

1*b*. Ventral view of the same, enlarged. Shows the tegmen in place; the five orals in their natural position, with calcified ambulacra entering between them and converging to an open mouth. × 2.

This is the famous specimen which first gave the clue to the tegminal structure of the Flexibilia; and is the only one ever found with the orals and ambulacra in their normal position and not sunken into the visceral cavity. The original figure has been copied many times.

2*a*. Another of the original types, a large flattened specimen; anterior view, showing the interbrachials to the third order and perisome following their distal margin. Abnormal in having 2 IBr in most of the rays.

2*b*. Posterior view of same; showing the exact form of posterior basal, the anal series rising from it, and the perisome leading to the tegmen.

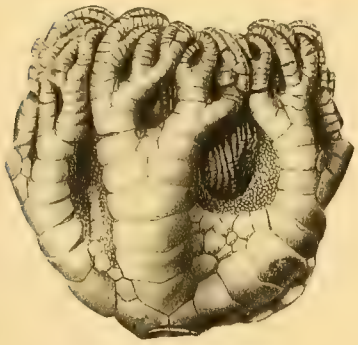
2*c*. Basal view of same with stem removed; showing IBB extending beyond the column facet, nearly equal in size.

3. Another type figured in 1888, flattened; r. post. view of complete crown. Shows distal margin of iBr, and connecting perisome following its curvature and rising high along the rays; the broad IBr, 3 IIBr, and rapidly diminishing size of the arms, with their coiled distal ends above the tegmen. Owing to pressure the l. post. R has been pushed against the anal plates, giving an unnatural appearance, and the upper part of the tube is turned edgewise, appearing narrower than it really is.

4. The fine specimen figured in 1890, Vol. VIII, Geol. Survey, Illinois, accompanying the description first prepared; somewhat flattened. Left posterior view; showing the rays in full, the anal tube to nearly its full extent, and the other characters of the species.
University of Chicago.

5, 6. Smaller specimens found associated with the above; fig. 6 has 2 IBr.
Kinderhook Gr.; Lower Carboniferous. LeGrand, Iowa.

All specimens figured on this plate, except that of fig. 4, in author's collection.



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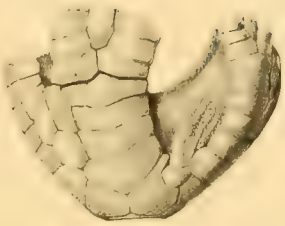

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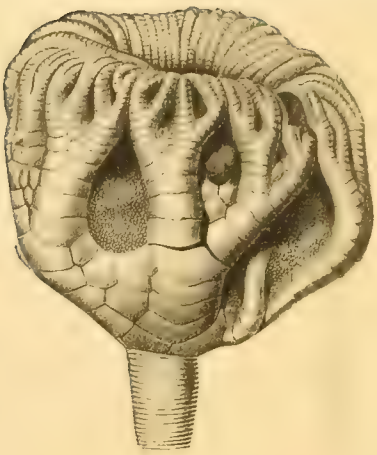

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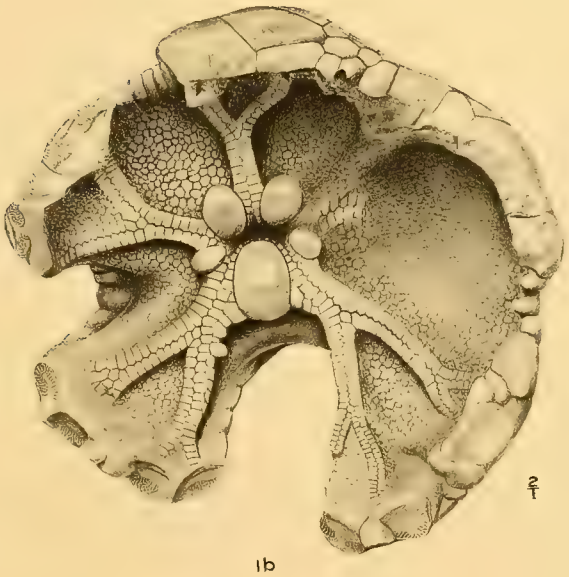

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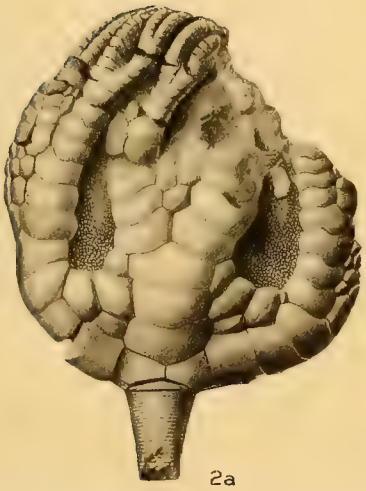
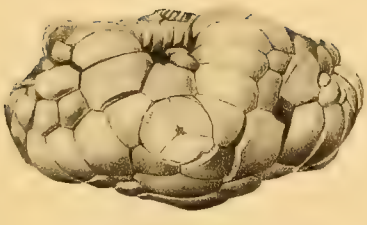


2a



2c

2b

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PLATE LIV

(All figures natural size except where otherwise stated)

PAGE

Fig. 1. **Taxocrinus nobilis** (Phillips) 394

FIG. 1*a*. The type, left posterior view. Drawn from a plaster cast of the original specimen in the Gilbertson collection in the British Museum, made after additional cleaning to bring out characters of the base and anal side not shown in Phillips's figures.

1*b*. Direct view of anal area, showing form of posterior basal. $\times \frac{3}{2}$.

1*c*. Detail of the base, showing BB, and very small IBB. $\times \frac{3}{2}$.

Mountain limestone; Lower Carboniferous. Yorkshire, England.

Fig. 2. **Taxocrinus belgicus** n. sp. 395

FIG. 2*a*. A nearly complete crown, anterior view. $\times 2$. Author's collection.

2*b*. Posterior view; showing post. B, with first plate of the anal tube *in situ*. $\times 2$.

Tournai Stage, Lower Carboniferous. Tournai, Belgium.

Figs. 3-11. **Taxocrinus juvenis** (Hall) 392

FIG. 3. The type, lateral view. Mus. Comp. Zool.

4, 5, 6, 7, 8, 9. A series of specimens showing the usual habitus of the species, and the variations in IIBr and IBr—fig. 9 having but 2 of the latter. Author's collection.

10. A large specimen from the same beds apparently of this species, showing strong development of interbrachials, which are few in the condition as usually found. Author's collection.

11*a*, *b*. Two views of a specimen with calyx distorted by a piece of a large stem pushed into it (11*b*), giving an entirely different form and proportions from the normal. Author's collection.

Lower Burlington limestone; Lower Carboniferous. Burlington, Iowa.

Figs. 12-13. **Taxocrinus ornatus** n. sp. 393

FIG. 12*a*. The type; a complete crown, anterior view; showing the full length of some arms, coiled to the extremity. Author's collection.

12*b*. Left posterior view of same; showing the peculiar ornamentation, pustulose in lower part and passing into longitudinal ridges in upper.

12*c*. Detail of surface of IBr, showing pustules. $\times 3$.

12*d*. Surface of IIIBr, with pustules replaced by ridges. $\times 3$.

13. Fragment of arms of another specimen, showing same kind of ornament. Author's collection.

Lower Burlington limestone; Lower Carboniferous. Burlington, Iowa.

Figs. 14-18. **Taxocrinus ramulosus** (Hall) 395

FIG. 14. A very mature specimen, with iBr profusely developed; anterior view.

15. Posterior view of a finely preserved specimen, showing the anal and interbrachial structures.

16. Lateral view of specimen with stem attached.

17, 18. Smaller specimens associated with the foregoing.

Upper Burlington limestone; Lower Carboniferous. Burlington, Iowa.

Specimens in author's collection.

Figs. 19-20. **Taxocrinus pustulosus** n. sp. 391

FIG. 19*a*. The arms from IAx up of a well-marked species characteristic of this horizon, of which the calyx has not been found; showing the strong pustulose ornamentation. Author's collection.

19*b*. Opposite side of same, showing articulating surfaces of brachials.

19*c*. Proximal surface of IBr from same, showing it to be of the *Taxocrinus* form. $\times 2$.

20*a*. Fragment of arms of another specimen, showing same ornament. Author's collection.

20*b*. Detail of higher brachial, showing pustules. $\times 3$.

New Providence shales (Knobstone); Lower Carboniferous. Clark County, Indiana, and Button Mould Knob, Kentucky.

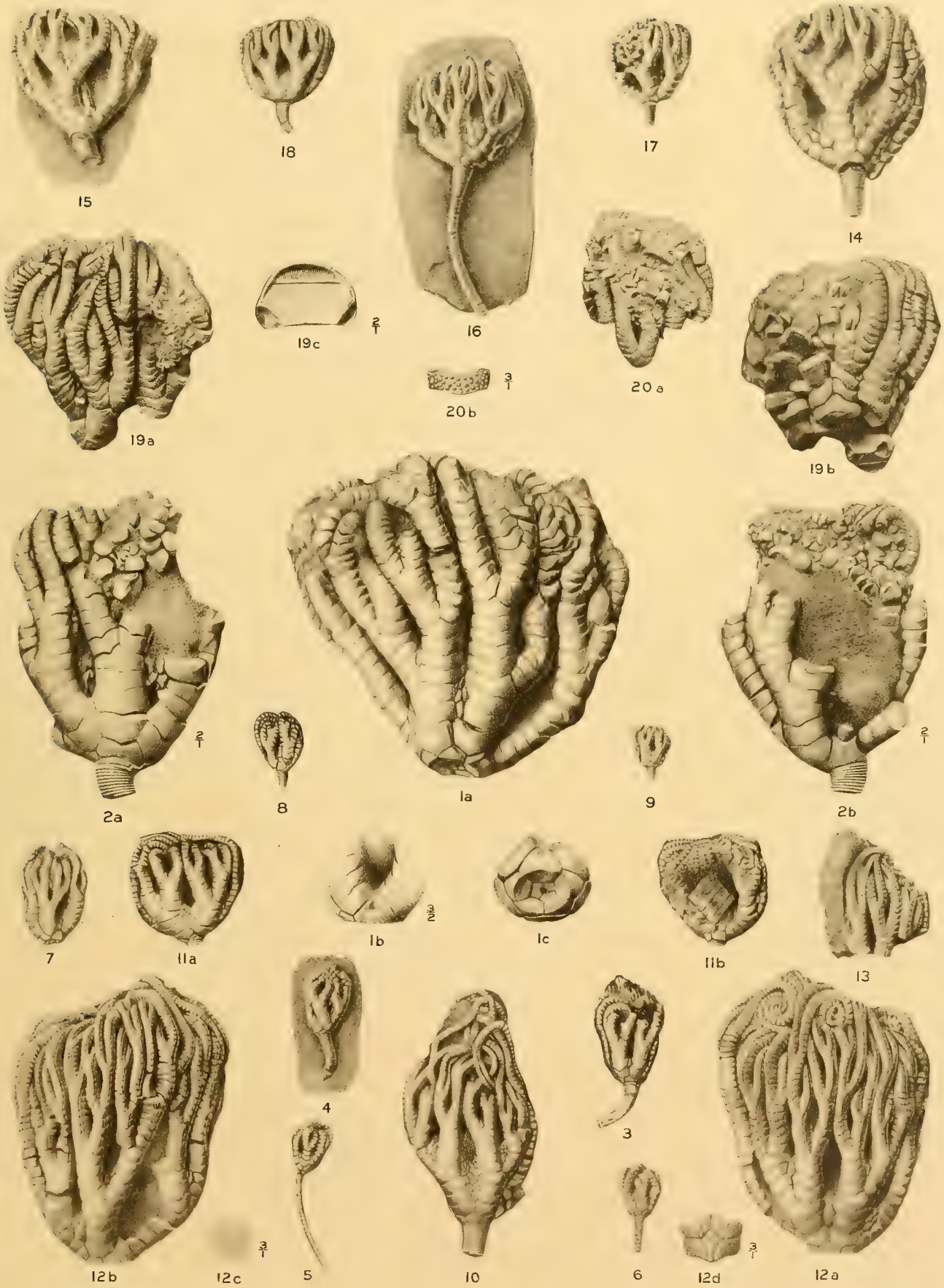
15
18
16
17
14
19a
19c
2/1
20b
3/1
20a
19b
2a
2/1
8
1a
9
2b
2/1
7
11a
1b
2/1
1c
11b
13
12b
12c
3/1
4
5
10
3
6
12d
3/1
12a

PLATE LV

(All figures natural size)

PAGE

Figs. 1-10. **Taxocrinus ungula** Miller and Gurley..... 397

FIG. 1. The type, showing the characteristic claw-like aspect of the rays; posterior view. University of Chicago.

2, 3, 4. A series of perfect, mature crowns, all more or less flattened, posterior view; showing the prominent and claw-like rays, anal and iBr structures, and the uniformly 3 IIBr.

5. Anterior view of a similar specimen, with stem attached; showing the arrangement of iBr plates to the third order, and the stem characters. Infolding distal ends of arms shown above iBr.

6. A large crown, with less conspicuous change in the arms above the IIIBr.

7. A more elongate variation of the species; it has 4 IIBr in two rami not shown in the figure.

8*a*, *b*, 9*a*. Characteristic young specimens, but little flattened, from the same colony as the preceding; showing small development of iBr; fig. 8 has 2 or 3, and fig. 9 only 1.

9*b*. R. ant. interradius, showing only 1 plate.

10. Young specimen with more elongate habitus than the others, having 4 IIBr in the anterior ray.

11. A very young specimen of *Taxocrinus colletti*, with no iBr at all, showing the contrast in contour with *T. ungula*, even at this young stage.

Keokuk Gr.; Lower Carboniferous. Indian Creek, Indiana.

All specimens figured on this plate, except that of fig. 1, are in the author's collection.

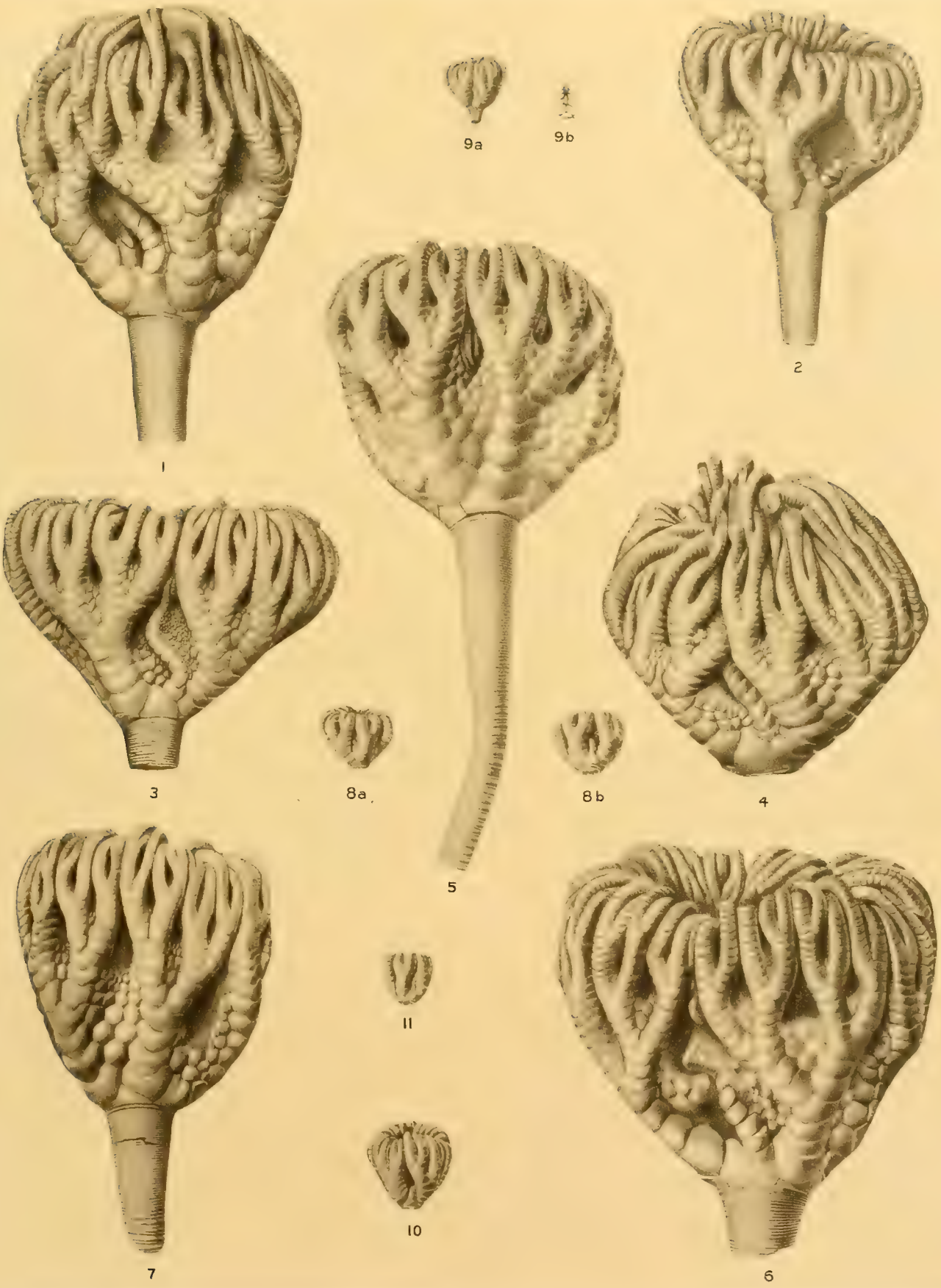

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PLATE LVI

PAGE

Figs. 1-11. **Taxocrinus colletti** White..... 398

(Also on Plates XXI, LVII)

(All specimens more or less flattened)

FIG. 1. The type specimen, anterior view; having normal number of IBr in three visible rays, with variation of 3 and 4 IIBr; and showing abrupt contraction of stem below the tapering enlargement. After White, but corrected by inserting a vertical suture line above the salient angle of the axillary IBr in anterior ray; the original figure is carelessly drawn. Whereabouts of specimen unknown.

2*a*. A perfect, mature crown, with 3 and 4 IIBr, posterior view. Shows pustulose ornament; base of anal tube and remnants of perisome to the right; inner margin of rays facing it rounded and without sutural attachment.

2*b*. The surface ornament, enlarged. × 2.

3*a*, *b*. Complete mature specimen, with stem and root preserved to the extremity, and some cirri attached toward distal end. It shows perfectly the abrupt change in the column near the calyx, and the beaded markings below, which are characteristic of the species; it has 3, 4 and 5 IIBr.

4, 5*a*. Medium sized specimens with few iBr; fig. 5 with nearly complete stem, having the pitted appearance due to more or less closely studded peripheral beads upon the edge of the columnals.

5*b*. Detail of stem on last specimen at the point of contraction, indicating 10 or 12 beads in the circumference, and showing the beginning of alternating columnals at that point. × 2.

6. Young individual, with only 1 iBr, and part of stem showing distinct whorl of beads or apparent pits between them; l. post. view.

7*a*, *b*. Anterior and posterior views of young specimen, *b* showing anal tube.

8. Young specimen with stem exceptionally without pitting, showing alternation of columnals below the contraction.

9, 10. Young specimens from Indian Creek; figure 10 with no iBr, and stem about complete, showing the great elongation of columnals characteristic of the young stage.

11*a*, *b*, *c*. Recuperated specimen from Crawfordsville, with a relatively small crown upon a large stem. The crown was broken off during life, leaving only infrabasals and one basal, all parts above these being restored by a new growth; producing an irregular crown, with 3 new, very unequal BB, and 4 RR, two of which are axillary, thus giving 6 rays.

a. R. ant. view, showing old basal, with distal faces still exposed. × 2.

b. L. post. view, showing large new basal. × 2.

c. Diagram, showing form and arrangement of plates; infrabasals and original basal are shaded.

Keokuk Group, Lower Carboniferous. Crawfordsville, Indiana, unless otherwise stated.

All specimens figured on this plate, except fig. 1, are in the author's collection.

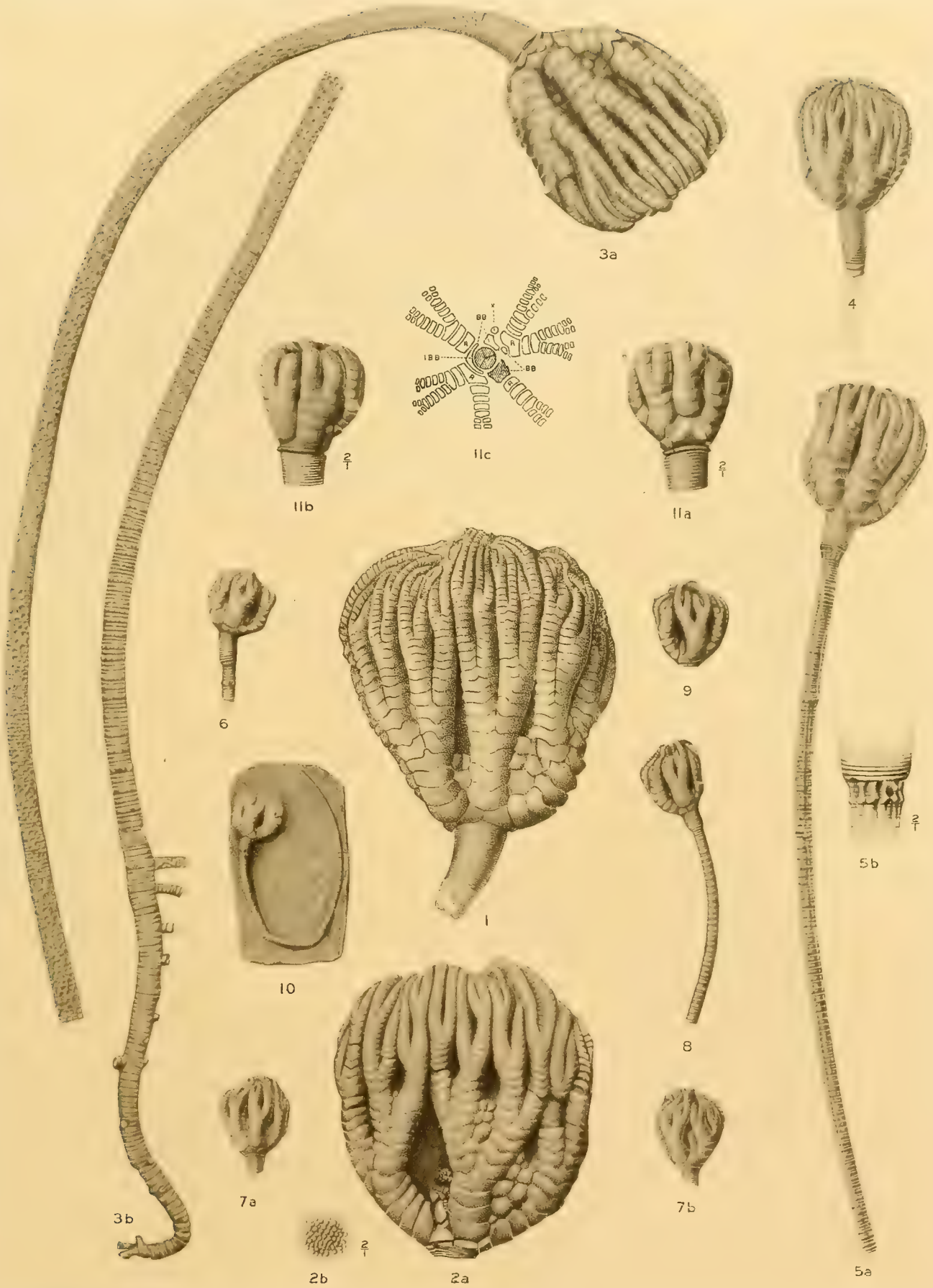

3a
4
IIc
IIb
IIa
6
1
9
5b
10
8
7a
7b
3b
2b
2a
5a

PLATE LVII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-10. **Taxocrinus colletti** White..... 398

(Also on Plates XXI, LVI)

(All specimens more or less flattened)

FIG. 1. Very mature, perfect crown with stem, having stem markings and arcuate sutures finely preserved; left anterior view.

2. Similar specimen showing distinct stem ossicles studded with beads; posterior view, with anal tube, and marginal perisomic plates at right side.

3*a*. Mature crown, anterior view; with surface well preserved, showing pustulate ornament, and plated perisome intact above distal margin of iBr plates.

3*b*. The surface markings, enlarged. × 2.

4. Specimen with less perfect surface, posterior view; showing form of post. B and adjacent plates free from anal tube.

5. Mature specimen, posterior view; with l. post. ray removed, showing lateral sutural face of iBr adjoining it; also exposing left side of posterior basal, with lower plates of anal tube resting in socket half way down the plate, and marginal perisome at the right.

6*a*. Similar specimen, dissected by removal of l. post. ray and part of right, showing remnants of tegmen underneath. The post. B with base of tube resting in its socket, and articulating margin of iBr to the left, are well shown. The removed parts are shown in accompanying figures. × 2.

6*b*. Part of r. post. ray of same specimen, ventral view, from axillary IBr upward; to show especially the longitudinal depression along the margin of brachials for attachment of perisome, commencing about the first secundibrach, or at the level of the last iBr. × 2.

6*c*. L. post. ray of same, lateral and ventral view. Shows left lateral articulating face of IBrs meeting the iBr exposed in fig. 6*a*; also longitudinal parallel grooves upon inner suface of plates passing to a more prominent median groove in the free arms; distal part somewhat displaced in the specimen, and brought into line here. × 2.

6*d*. Radial and two IBr from fig. 6*c*, showing opposite, or right lateral, face next to anal interradius. Note the total absence of sutural attachment. × 2.

6*e*. Proximal face of radial from same. × 2.

6*f*. Distal face of IBr_2, detached from same. × 2.

7*a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*. Detached brachials from similar specimen; to show their form and proportions in different parts of ray;—

7*a*, IBr_1, proximal view; *b*, IBr_2, distal; *c*, IBr_3, proximal; *d*, IIIBr just above axillary, distal; *e*, *f*, *g*, *h*, higher IIIBr, various proximal and distal views. All × 2.

8*a*. Calyx and lower brachials of a specimen entirely free from matrix inside and out; ventral side, with tegmen and arms broken off; showing especially the rounded crescentic distal margin of iBr, curving to meet the rays, and also the rounded margins of both posterior rays.

8*b*. Posterior view of same. Shows post. B and socket for support of anal tube, and the rounded right lateral margin of l. post. ray, with total absence of sutural surface.

9. A weathered specimen, with surface removed in some parts by erosion. Shows perfectly straight sutures between brachials in those parts, while corresponding sutures in the unaltered parts are sinuous (the so-called "patelloid plates")—proving that the arcuate suture pertains only to the surface.

10*a*, *b*, *c*. A malformed specimen having 6 rays, and only 4 basals. The rays are irregular, and not all perfectly formed; and the basals are very unequal.

a. Anterior view. × 2.

b. Posterior view. × 2.

c. Diagram showing form and arrangement of plates.

Keokuk Gr.; Lower Carboniferous. Figs. 1 and 2 from Indian Creek, the others from Crawfordsville, Indiana.

All specimens in the author's collection.

1
2
3a
3b
4
5
6a
6b
6c
6d
6e
6f
7a
7b
7c
7d
7e
7f
7g
7h
8a
8b
9
10a
10b
10c

PLATE LVIII

(All figures natural size)

PAGE

Figs. 1-8. **Taxocrinus praestans** n. sp..... 404

FIGS. 1, 2. Two mature crowns, more or less flattened, with enlarged proximal part of stem attached; anterior and left lateral views. Shows the 4 IIBr; profuse development of iBr plates and their characteristic arrangement, with crescentic distal margin; the tongue-like salient angles of BB; and the stem without any sudden contraction. Indian Creek, Indiana.

3. Posterior view of similar specimen, with most of anal series broken away; tube evidently merged in strong perisome. Same locality.

4. A very large, much flattened specimen, with BB more angular; from equivalent beds at Canton, Washington County, Indiana.

5, 6, 7. A series of young specimens, all flattened, with two, one, or no iBr plates; found associated with those of figures 1, 2, 3. Fig. 5 has two iBr in r. post. interradius concealed by crushing; fig. 6, has three iBr in some areas. Indian Creek, Indiana.

8*a*, *b*. Anterior and posterior views of a young specimen from the same beds and locality, with stem slightly constricted, and an extra bifurcation in r. post. ray. Perhaps *T. colletti*. Indian Creek, Indiana.

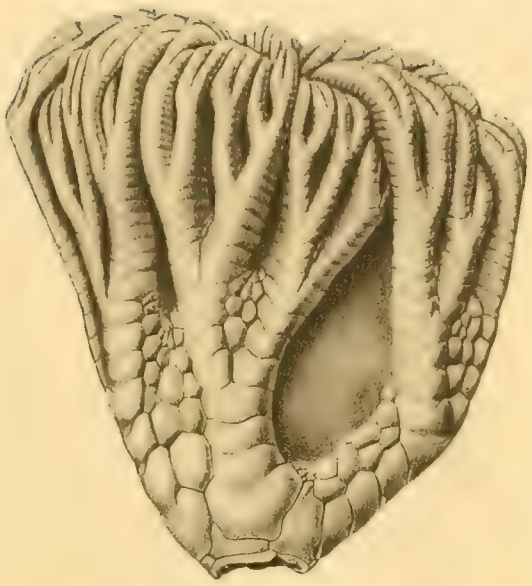
Keokuk Gr.; Lower Carboniferous. Indiana.

All specimens in the author's collection.

1

8a

8b



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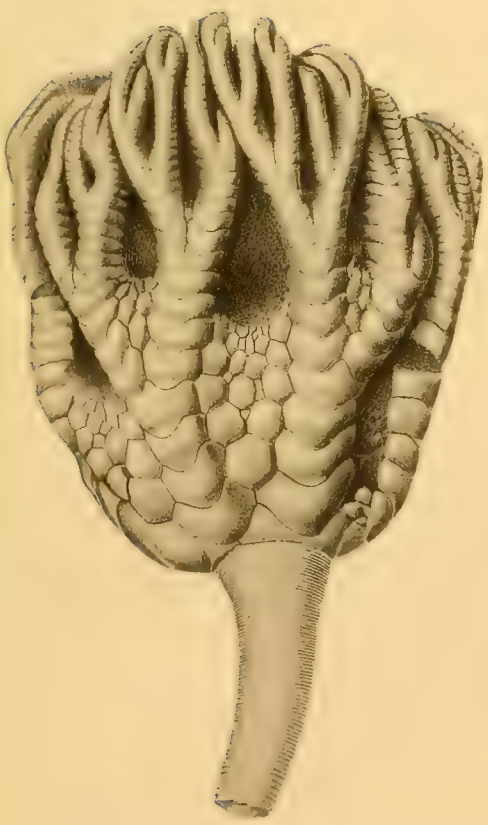

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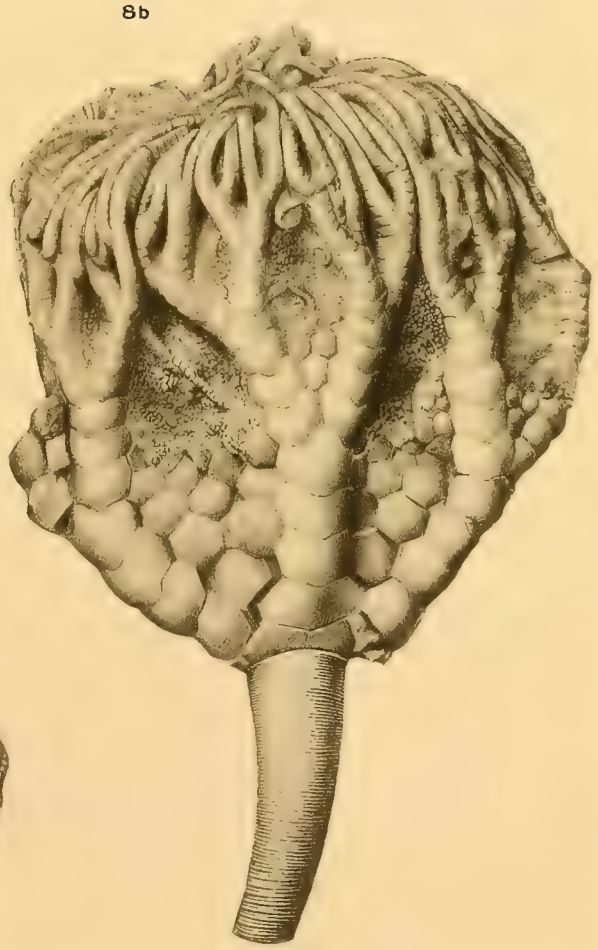

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PLATE LIX

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-12. **Taxocrinus giddingei** (Hall)..... 405

FIG. 1. The type, posterior view. Am. Mus. Nat. Hist. Boonville, Missouri.

2, 3. Posterior view of specimens with the anal side well preserved; showing how the median series is bordered by rather strong, well-formed plates, resembling those of *Forbesiocrinus*, yet originates on an indentation at the right shoulder of posterior basal as in *Taxocrinus*.

4. Posterior view of another specimen with the anal series more distinctly of the *Taxocrinus* type.

5, 6, 7, 8, 9. Anterior and lateral views of specimens showing the profuse development of interbrachial plates; and how, instead of rising to an apex filling the area, they have a crescentic distal margin connecting with perisome, and rising at the sides to meet the rays. Note especially figs. 5, 6 and 8 for this.

10. Enlarged anterior view of another specimen, to show the perisomic integument of small plates following the interbrachials. × 2.

11. Type of S. A. Miller's "*Forbesiocrinus elegantulus*."

12. A specimen from Canton, Indiana, perhaps of this species.

Warsaw or Upper Keokuk Gr.; Lower Carboniferous. Boonville, Missouri, except as otherwise stated.

Figs. 13-16, 19. **Taxocrinus shumardianus** (Hall)..... 406

FIG. 13. The type, a rather large, flattened specimen showing iBr touching BB; anterior view. University of Illinois. St. Louis, Missouri.

14*a*. A very mature specimen from the original locality at St. Louis; dorso-ventral view. Shows the taper of the arms to the fourth bifurcation, the exact disposition of the interbrachial plates and how they connect by a broad truncation with the basals.

14*b*. Ventral side of same, completely freed from matrix except enough to hold the arms in place. It shows remnants of the tegmen, fallen to the bottom of the visceral cavity; the oral plates somewhat displaced, and not all equally exposed; one indistinct ambulacrum seen passing in between the orals; the distal margin of the posterior basal and the small anal tube following it, as well as the rounded margins of the posterior rays adjoining the anal area.

This figure and the last are drawn reversed from left to right, and certain arms lettered a, a^1, etc., for comparison; those at e, e^1 are distended and folded abruptly backward upon themselves to the dorsal side, while those at a, a^1, b, b^1, etc., are retracted and folded inward ventrally.

15. Anterior view of specimen from same locality.

16. Basal view of small specimen from same locality, showing iBr connecting with all BB by definite sutures; r. ant. interradius at the top. Drawn slightly expanded to show relation of all BB.

19. Lateral view of small specimen from Waterloo, Illinois.

St. Louis Gr.; Lower Carboniferous. Missouri and Illinois.

Figs. 17-25. **Taxocrinus huntsvillae** n. sp..... 407

FIG. 17*a*. Posterior view of small specimen, showing anal tube and bordering perisome. Huntsville, Alabama.

17*b*. Stem of this specimen detached, showing IBB fused to top columnal. × 2.

18. Posterior view of another specimen from same locality.

20. Anterior and lateral views of similar specimen from same locality; showing the iBr connecting with BB in varying degrees.

21. Small specimen from same locality with stem nearly complete, showing the distal lengthening of the alternate columnals; iBr in one area does not connect with B.

22. Small specimen from same locality in which none of the iBr connect with BB.

23, 24, 25. Specimens from the higher Kaskaskia beds at the same locality. In these and several others from this horizon, but not in all, the iBr do not connect with BB.

Lower part of Kaskaskia Gr.; Lower Carboniferous. Huntsville, Alabama.

All specimens figured on this plate, except those of figs. 1 and 13, are in the author's collection.

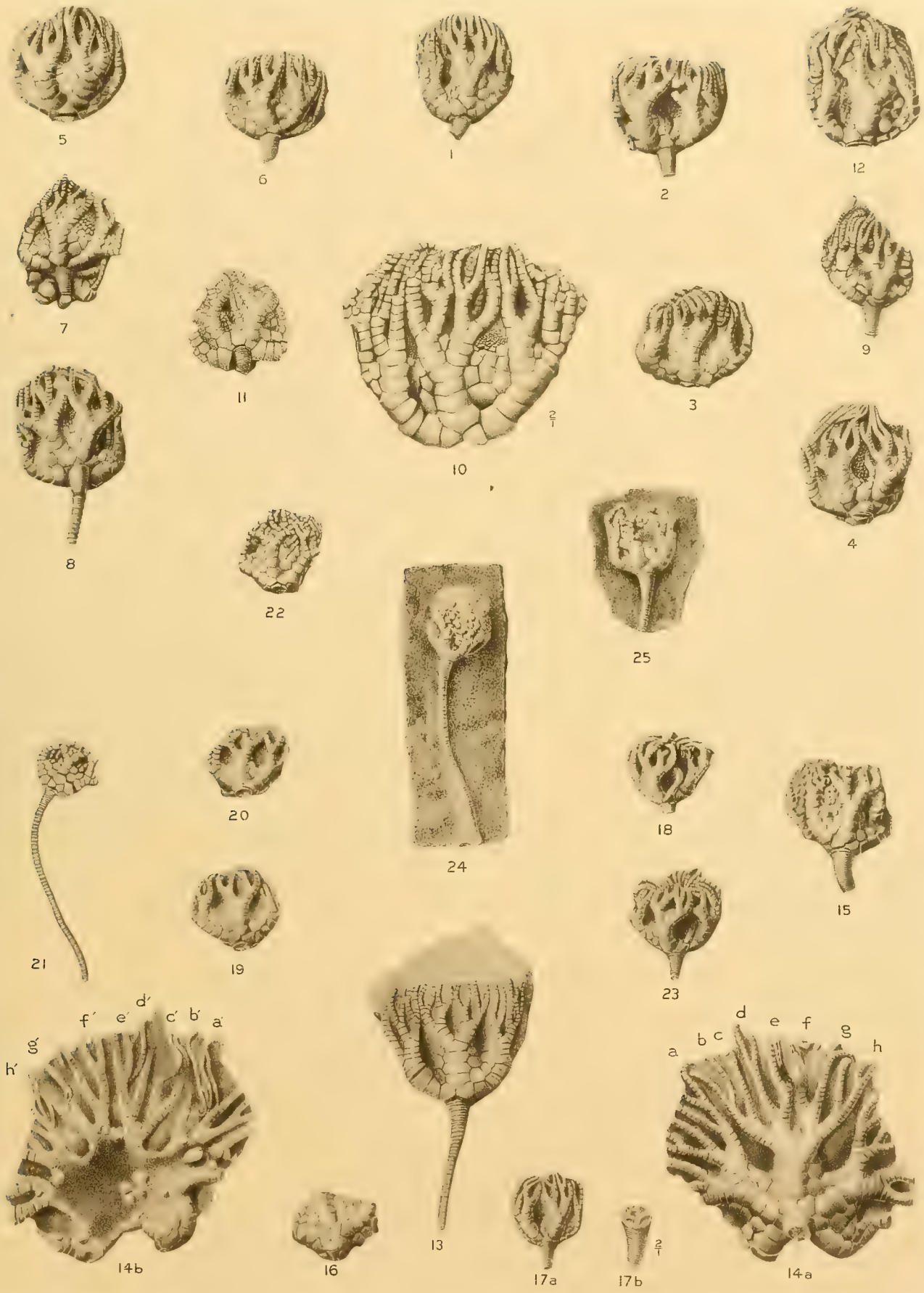

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PLATE LX

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-11. **Taxocrinus whitfieldi** (Hall) 408

FIG. 1. Basal view of type; showing the large iBr and small anal tube; 2 IIBr all around. University of Illinois. Chester, Illinois.

2. A very mature, rotund crown, basal view; drawn with anal side to the right. Anal tube, and weak perisome in posterior interradius in contrast with the solid iBr to the height of IIBr in other areas; some iBr touch BB. Pulaski County, Kentucky.

3*a*. Right anterior interradial view of a similar specimen from same locality.

3*b*. Basal view of same; iBr do not connect with BB; 2 IIBr all around.

3*c*. Distal view of same, showing the short, infolding arms.

3*d*. Outline of posterior radius, showing the division series, or intervals between axillaries. R + 2 IBr occurs in this ray only; 2 IIBr only in inner rami.

4. Posterior view of similar specimen from same locality; showing anal area with tube bordered by perisome, but no solid plates; and the limit of iBr.

5. Large specimen with stem, anterior view; showing distal margin of iBr with perisome following; 2 IIIBr to inner rami. Same locality.

6 (erroneously printed 6*d*). A laterally flattened specimen, showing structure and proportions of stem. Has 2 IIBr; 2 IIIBr on inner rami; and exceptionally but 2 IBr (only 5 out of 34 specimens have 2 IBr). Same locality.

7. A flattened specimen with normal IBr, r. post. view. Grayson Springs, Kentucky.

8. Basal view of smaller specimen, showing same structure as fig. 3; iBr connects with BB in one area. Pulaski County, Kentucky.

9*a*. Young specimen, flattened; has 2 IBr; some iBr touch BB. Same locality.

9*b*. Right posterior view of same.

10*a*. Very young individual in the stage of Wetherby's "*Forbesiocrinus*" *parvus;* posterior view. Same locality.

10*b*. Right posterior view of same, enlarged. × 2.

11. Type of Hall's "*Forbesiocrinus*" *cestriensis,* laterally compressed. University of Illinois. Chester, Illinois.

Upper part of Kaskaskia Gr.; Lower Carboniferous. Illinois and Kentucky.

Fig. 12. **Amphicrinus carbonarius** n. sp. 341

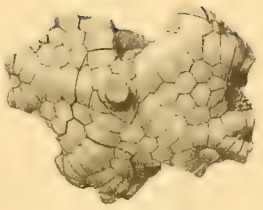
FIG. 12*a*. A crushed specimen, with calyx plates displaced so that their arrangement cannot be definitely ascertained. It is the latest known occurrence of the Flexibilia in America, and the general facies of the specimen points clearly to an affinity with the form from an approximately equivalent horizon in Scotland, illustrated on Plate XL, figs. 9-11.

12*b*. Distal part of arms of the same.

Pennsylvanian (Lower Coal Measures). Girard, Kansas.

All specimens in the author's collection unless otherwise stated.

6d



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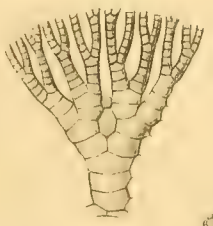

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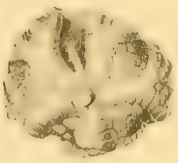

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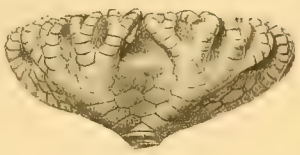

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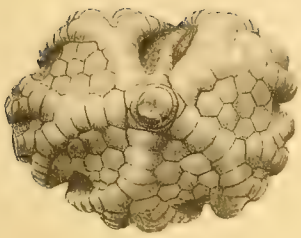

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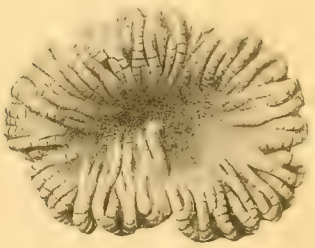

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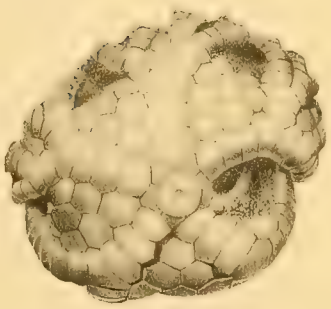

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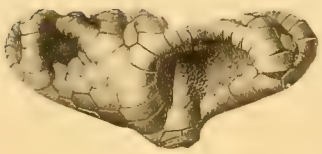


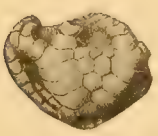
4

9b

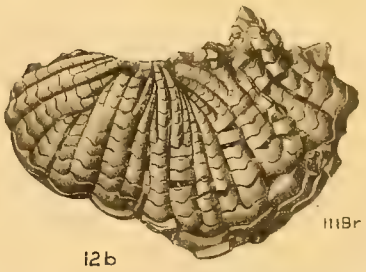
9a

10a

12a



10b



12b

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PLATE LXI

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-16. **Parichthyocrinus nobilis** (Wachsmuth and Springer) 412

FIG. 1*a*. The type, distorted and imperfect as to base and anal side, being all that was known when the species was described; antero-lateral view. Shows rays from first bifurcation up, and the maximum number of iBr known in this species at the exterior.

1*b*. The same from radial view to the right. iBr plates in one interradius numbered for comparison with next figure; only three visible at the exterior.

1*c*. Inner surface of plates of the interradius marked in fig. 1*b*; showing the 3 iBr which appeared on the outside, here much larger in area, and 4 more which did not come through.

1*d*. Proximal face of plates shown in 1*c*, showing wedge form of iBr; the plate alongside of No. 1 narrowing to a point before reaching exterior of calyx wall.

2*a, b, c, d*. Dorsal, ventral, right and left lateral views of a fragment of l. post. ray of same specimen, containing R, three IBr, and one IIBr, being the plates next to the anal area; numbered for comparison; 1 = R. They show the totally different form of these plates at the exterior and interior, and their singular modification by proximity of anal structures, from which some of the brachials are crowded entirely away; *e. g.* in this set No. 3 does not reach the inner surface, while No. 1, the radial, is enormously enlarged, and extended inward next to the anal area. The right margin (2*c*) is perfectly rounded, showing the complete absence of any sutural attachment to anal plates.

3*a, b, c, d*. Dorsal, ventral, distal and lateral views of another detached fragment from same specimen, having parts of 2 rays, and accompanying iBr. The 8 iBr that are visible at the exterior (3*a*) are numbered; 6 more besides these are well developed at the interior (3*b*); 3*c* and 3*d* show how those that do not come through are wedged in between the brachials, sometimes two deep, tapering to fine points or edges, while the brachials taper oppositely to fit them. This specimen explains the essential nature of interbrachials as supplementary plates, developed at the inner side of the test to fill up spaces between the rays and their divisions, as the growth of the visceral mass caused expansion of the calyx.

4. Distal face of axillary IIBr, from same specimen. × 2.

5, 6. Proximal and distal faces of IIIBrs. × 2.

7, 8. Proximal and distal faces of IVBrs. × 2.

9. Proximal face of VBr. × 2.

These specimens show the gradual development of an ambulacral furrow, from none at all in the lower brachials, to a distinct groove with space for side pieces, toward the distal region.

10*a*. A remarkably perfect, mature specimen, somewhat flattened; anterior view, showing the close interlocking of the rays above the iBr areas.

10*b*. Posterior view of same; showing the small anal tube, not suturally connected with adjacent rays, and how the posterior rays close above it.

11. Basal view of another specimen, anal side to the left. Shows form of post. B, with anal series rising from a socket probably below its distal margin; and the rounded margins of posterior rays, not adapted to sutural attachment—a perfect Taxocrinoid anal side. Note the small size of r. post. radial.

12. Posterior view of a similar specimen, somewhat crowded, so that l. post. R partly overlaps post. B, concealing the shoulder to left of tube plates.

13. Anterior view of a mature specimen, showing maximum development of iBr.

14. Less mature specimen, with part of stem, posterior view; showing post. B (partly covered by l. post. R), the anal structures, and the much reduced r. post. R. Note the peculiar narrowing of one or more IBr toward the anal area, sometimes to a knife-edge, not reaching margin of the ray at all,—a feature common to this genus, resulting from the curvature of the posterior rays over the anal area.

15. Young specimen with only one interbrachial.

16. Still younger specimen, in which interbrachials have not been developed.

Upper Burlington limestone; Lower Carboniferous. Burlington, Iowa.

All specimens are in the author's collection.

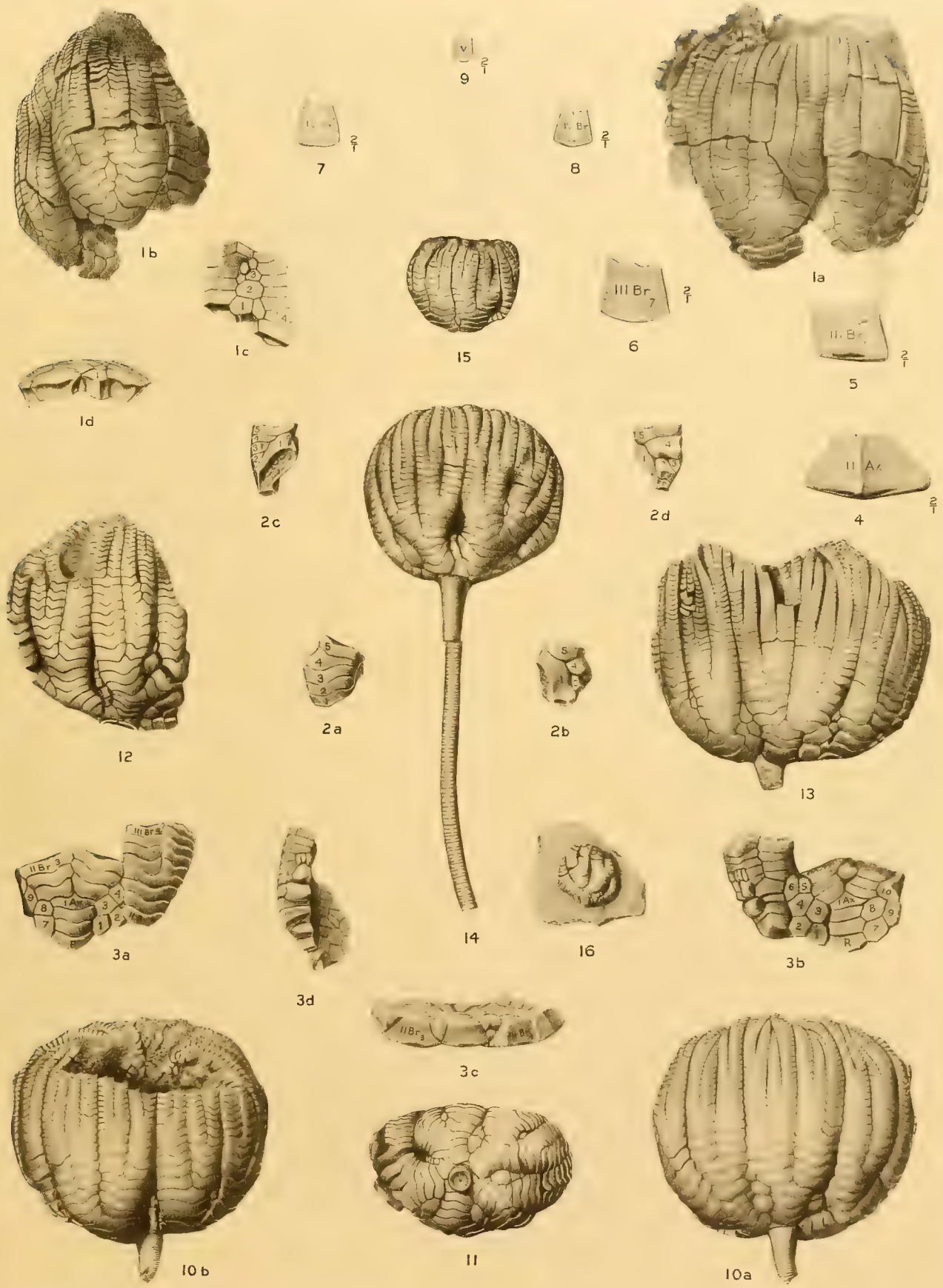
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PLATE LXII

PAGE

Figs. 1-3. **Parichthyocrinus meeki** (Hall) 414

FIG. 1. The type, after additional cleaning; showing form of anal area, not seen in Hall's figure. University of Illinois. Warsaw, Illinois.

2a. A magnificent, mature, and almost perfectly rotund specimen, found by the late Lisbon A. Cox, at Nashville, Iowa; anterior view, with proximal part of stem attached, showing the relative shortness and great breadth of the crown. Author's collection.

2b. Basal view of same with stem removed. Shows IBB entirely covered by the stem, but themselves overlapping BB; the greatly enlarged post. B, and the anal series following; the rounded margins bordering the anal area; and the maximum number of interbrachials for the species.

3. A less mature, almost rotund, specimen from same locality, with stem nearly complete, antero-lateral view; iBr much fewer than in preceding. Author's collection.

Base of Keokuk limestone; Lower Carboniferous. Iowa and Illinois.

Figs. 4-17. **Parichthyocrinus subovatus** (Miller and Gurley) 415

(Also on Plates XXI; LXIII)

FIG. 4. The type, lateral view, University of Chicago. Near Salem, Indiana.

5a. A mature specimen, slightly flattened; from anterior radius, showing maximum number of interbrachials. Indian Creek, Indiana.

5b. Right posterior view of same, showing anal area.

5c. Distal view of same, showing closely infolding arms.

6. Another mature flattened specimen from same colony, anterior view.

7. Posterior view of similar specimen from same colony; lower part of anal area narrowed by pressure.

8a. Basal view of less mature specimen, vertically compressed, showing all the rays and anal structures in perfect condition; IBB smaller than column facet, but not within ring of BB. Note reduced size of r. post. radial as compared with that of *Forbesiocrinus* from the same beds, Pl. XXVIII.

8b. Distal view of same, showing close abutting of arms.

9. A mature specimen with most of stem attached, same locality and colony.

10. R. post. view of specimen with IBB visible as low ring below column; *a*, the anal area.

11. Posterior view of similar specimen.

12, 13, 14, 15, 16, 17. A series of successively younger specimens from the same colony as the seven preceding, showing the diminishing number of interbrachials.

Upper part of Keokuk Gr.; Lower Carboniferous. Indiana. All except the type are from Indian Creek, Montgomery County.

All specimens except that of fig. 4 are in the author's collection.

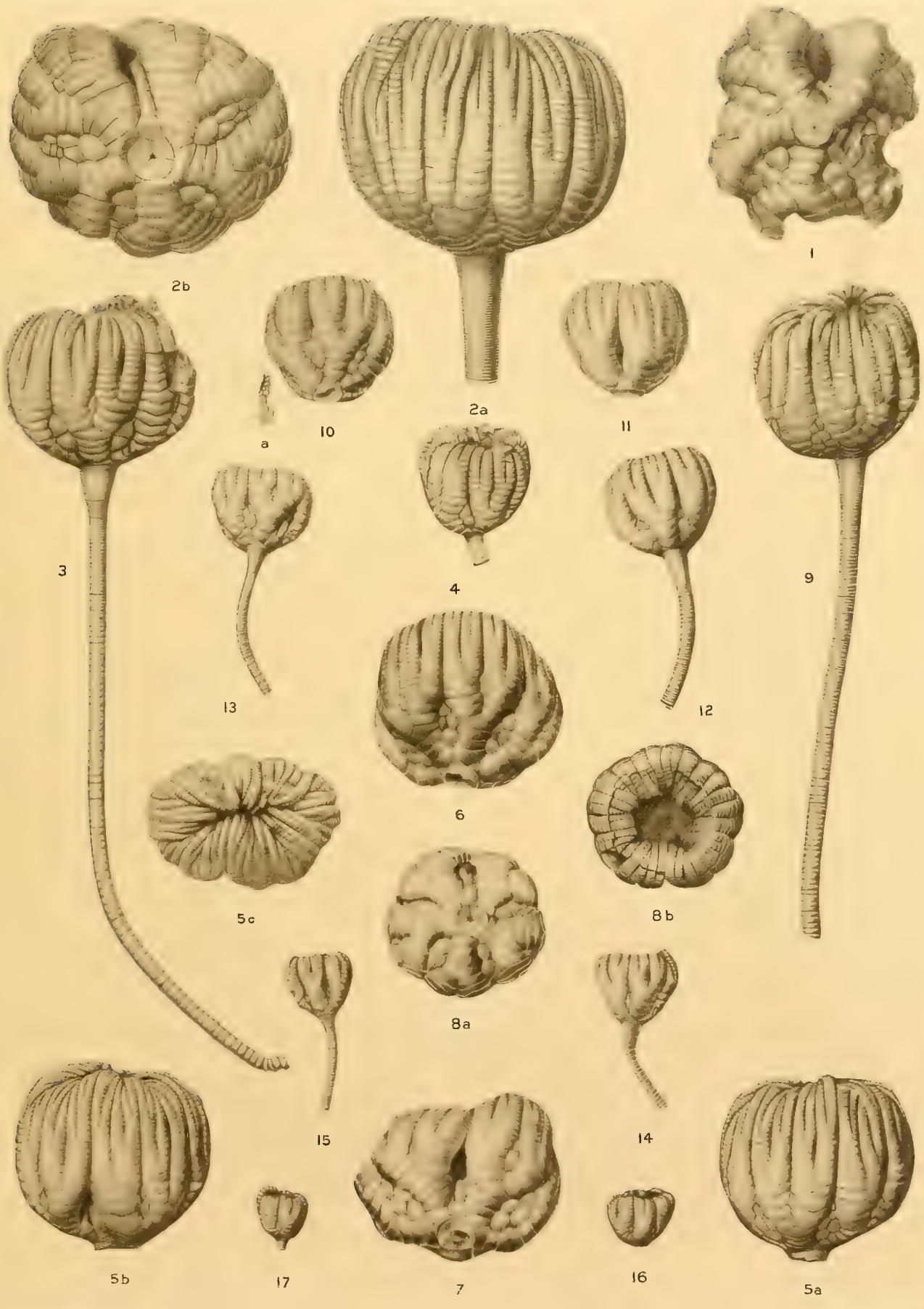

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PLATE LXIII

(All figures natural size except where otherwise stated) PAGE

Figs. 1-4. **Parichthyocrinus subovatus** (Miller and Gurley) cont..... 415
(Also on Plates XXI; LXII)

FIG. 1, 2. Mature and young specimens from same locality as those on preceding plate, with stems complete, showing the presence of cirri irregularly toward the root. Author's collection.

3*a*, *b*. Left anterior and basal views of a specimen from the same locality and associated with the foregoing, having sporadically the anal structure somewhat similar to that of *Euryocrinus*. Author's collection.

3*c*. Anal plates of same, showing perisome in upper part.

4. Base of a free calyx, showing relation of IBB to adjoining plates in many representative specimens. × 2. Author's collection.

Upper part of Keokuk Gr.; Lower Carboniferous. Indian Creek, Indiana.

Figs. 5-6. **Parichthyocrinus crawfordsvillensis** (Miller and Gurley)..... 416

FIG. 5. The type; posterior view not figured by the authors; showing modification of anal structures in the direction of *Forbesiocrinus*. A very mature individual, with strong development of interbrachials, and the base considerably distorted. From the Crawfordsville crinoid bed, a different horizon from the preceding. University of Chicago.

6. Less mature specimen from same beds at Crawfordsville; lateral view, showing same characters as the last specimen, together with complete stem and distal cirri. Author's collection.

Keokuk Gr.; Lower Carboniferous. Crawfordsville, Indiana.

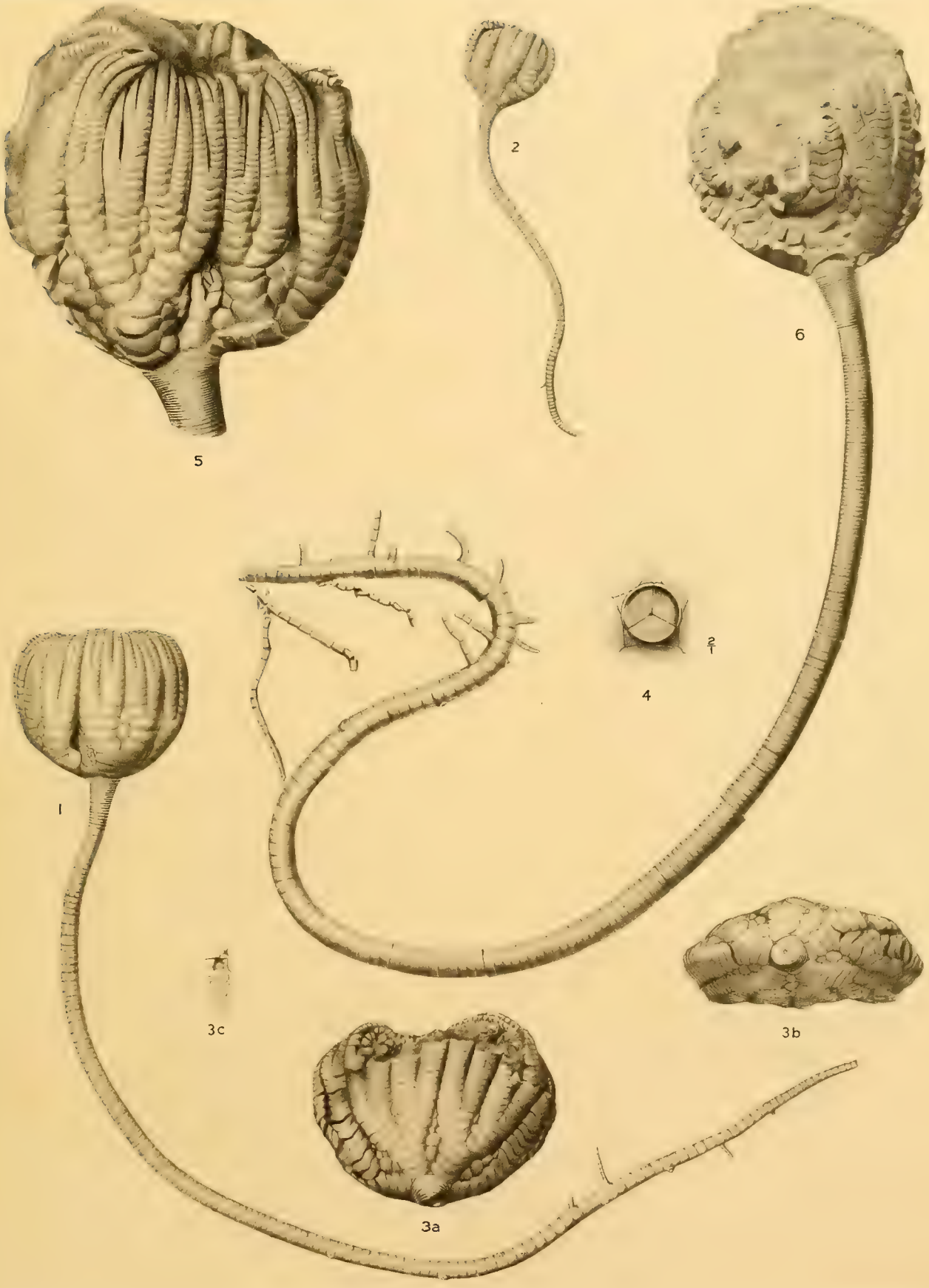
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PLATE LXIV

(All figures natural size)

PAGE

Figs. 1-10. **Onychocrinus asteriaeformis** (Hall)..... 422

FIG. 1. One of the type specimens, anterior view; showing division of the rays into two main trunks, or rami, with ramules branching only to the outside of the dichotom. Author's collection.

2. Dorsal view of cotype, with three complete rays preserved. A very mature individual, with the rami joined by suture for five ranges of plates above the axillary. Mus. Comp. Zool.

3. A finely preserved, mature specimen with part of stem attached, and anal tube in place; posterior view; rami joined for four ranges of brachials. Author's collection.

4. Lateral view of specimen with infrabasals separated from basals and fused to the top columnal; ramules branching. Author's collection.

5. Right posterior view of a specimen with completely developed interbrachials. Author's collection.

6. Crushed specimen, showing form of posterior basal. Author's collection.

7. Basal view of specimen with infrabasals in position. Author's collection.

8. Specimen showing curved distal margin of interbrachials.

9. Specimen with rami connected for a less distance than in the preceding. Author's collection.

10. Young specimen with rami free from the axillary up, and but a single interbrachial plate. Author's collection.

Upper Burlington limestone; Lower Carboniferous. Burlington, Iowa.

Figs. 11-14. (?) **Onychocrinus polydactylus** (M'Coy)..... 439

FIG. 11. M'Coy's figure of type: Carb. Foss. Ireland, pl. 26, fig. 7. This is a composite figure, partly restored. See fig. 12.

12. The principal type specimens from which the foregoing figure was drawn, presumably belonging to the same individual; here placed in their probable relative positions, and the missing plates drawn in outline. Science and Art Museum, Dublin.

Ballintrillick, Bundoran; county Donegal, Ireland.

13. Cotype not figured by M'Coy; fragment with base and a ray having R + 5 IBr, the last not axillary; showing that there may have been six primibrachs. Same collection.

County Sligo, Ireland.

14. Phillips's figure of *"Poteriocrinus" egertoni;* Geol. Yorkshire, II, pl. 3, fig. 39; probably a young individual of this species, and the figure probably incorrect at ends of rays, the pointed appearance of which being due to incomplete removal of the matrix in preparation. Said to be from Enniskillen, Ireland. The type specimen cannot be found either at London or Dublin.

Mountain limestone; Lower Carboniferous. Ireland.

Fig. 15. **Onychocrinus** sp..... 420

FIG. 15*a*. Fragment of ramus with bilateral branching of ramules, dorsal view. From the Knobstone, base of Lower Carboniferous, Kentucky; showing the occurrence of the genus at that horizon. Author's collection.

15*b*. Side view of same.

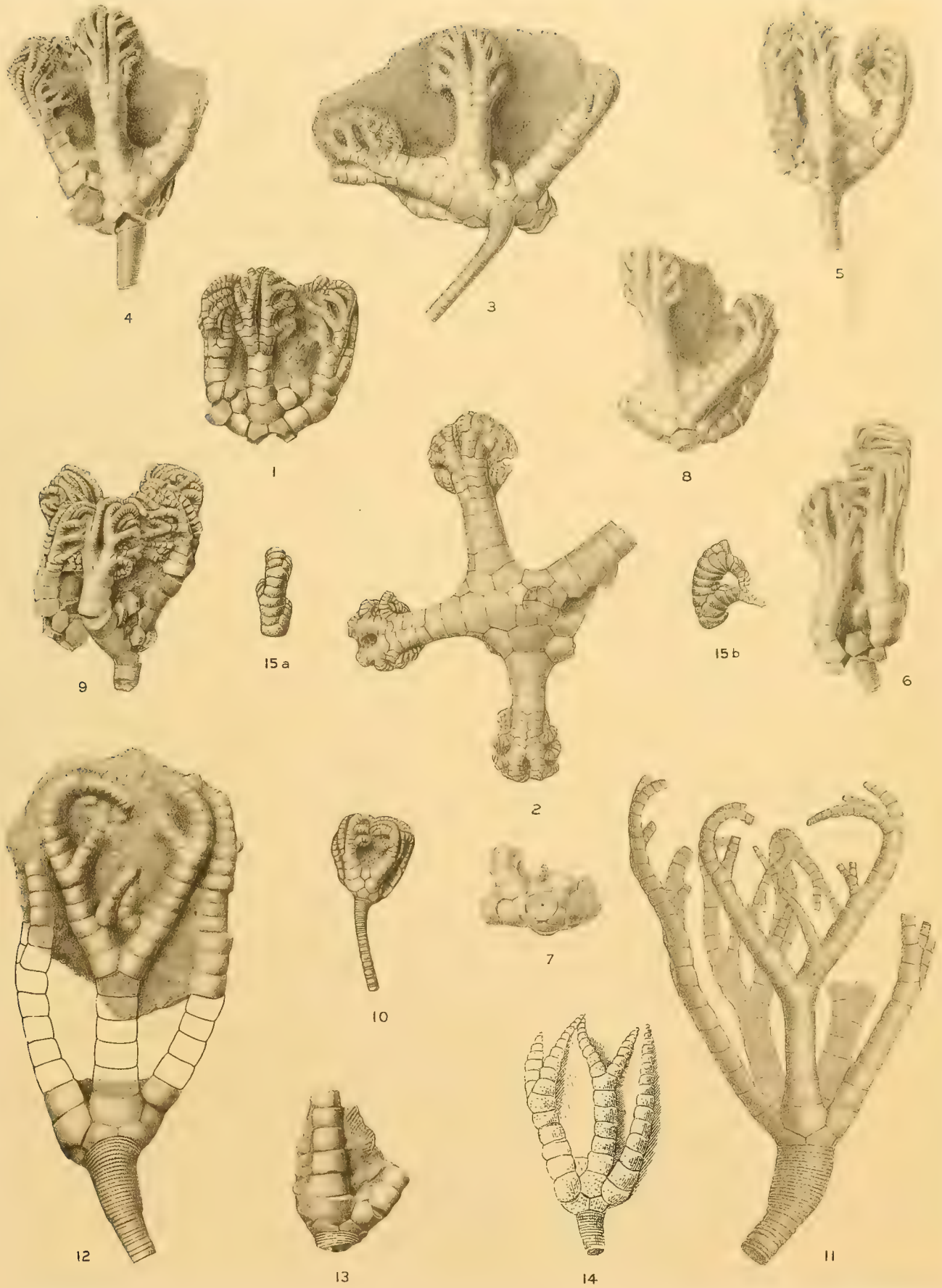

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PLATE LXV

(All figures natural size)

PAGE

Figs. 1-7. **Onychocrinus diversus** Meek and Worthen..... 423

(Also on Plate LXVII)

FIG. 1. The principal type specimen, with one complete ray, and three others partly preserved; dorsal view. Main rami with ramules branching alternately in clusters; joined for four ranges of brachials. Mus. Comp. Zool.

2. Cotype in same collection, after additional cleaning; ventral view showing infolding of distal ends of ramules. The posterior oral and displaced fragments of ambulacra are preserved, but the remainder of the tegmen is destroyed.

3. Dorsal view of a mature specimen, with rays extended so as to show the exact mode of branching of ramules. Terminal rami of r. post. ray partly restored from another specimen; r. ant. ray abnormal and probably recuperated. Author's collection.

4. Posterior view of another specimen with rays not extended, showing the posterior basal, and origin of anal tube. Author's collection.

5. Young specimen, horizontally extended, with rami joined only to the second range above axillary; dorsal view. Some ramules partly restored in outline from another specimen. Author's collection.

6. A still younger specimen, with stem attached; has rami united only to first range above axillary. Author's collection.

7. Proximal part of stem of a very mature specimen, showing strong curvature of nodal columnals. Author's collection.

Upper Burlington limestone; Lower Carboniferous. Burlington, Iowa.

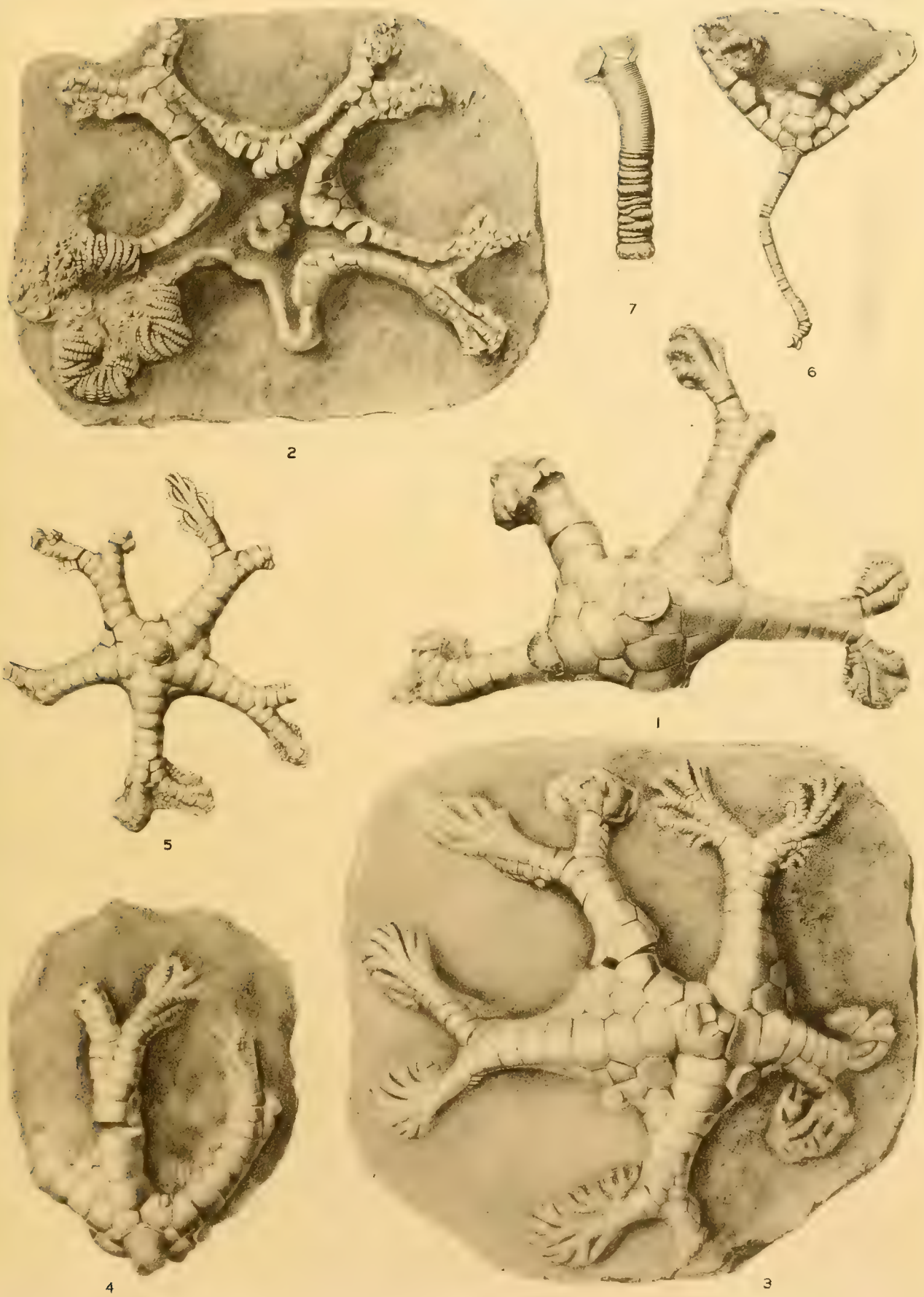

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PLATE LXVI

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-10. **Onychocrinus ulrichi** Miller and Gurley..... 425

(Also on Plates XXI, LXVII and LXVIII)

FIG. 1. The type, after additional cleaning; posterior view. It shows the relatively shorter and heavier rami than in the last species, and a more mature developmental stage, with strong interbrachials between the rami. University of Chicago.
Indian Creek, Indiana.

2. A remarkably perfect specimen from Indian Creek; posterior view. Shows the strong anal tube rising from the outer side of posterior basal, and the perisome connected with it extending far up the rays. Note that the tube, originating on the right side of the posterior basal, first leans to the left impinging upon the left posterior radial, in which by contact and motion of the flexible calyx it produces a vertical groove (see text-fig. 8); this does not occur in all specimens. Compare Pl. LXVIII, figs. 1, 4, 5, to show the amount of expansion of which this calyx is capable.

3. Anterior view of a similar specimen from same locality, showing extent of interbrachial structures and their crescentic margin, rising high up along the rays. Author's collection.

4. Similar specimen from same locality and collection, with stem attached (only part of it is drawn).

4*a*. Diagram of a ramus from same specimen, showing the diminishing size of clusters distally.

5, 6, 7, 8*a*, *b*. A series of successively younger specimens down to fig. 8, which has but one interbrachial and the rami joined by only a part of one pair of brachials. Author's collection. Indian Creek, Indiana.

6*a*. Diagram of a ramus from fig. 6, showing the small development of clusters of ramules in young individuals.

9. Type of Miller and Gurley's *O. cantonensis*, from near Canton, Indiana; representing a young form of this species or of *O. diversus*. University of Chicago. Exact horizon uncertain, possibly Burlington.

10. A specimen with more slender rays than those from Indian Creek, from equivalent beds in Washington County, Indiana. Author's collection.
Keokuk Group; Lower Carboniferous. Indiana.

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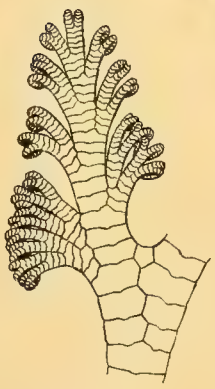

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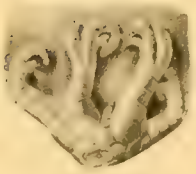

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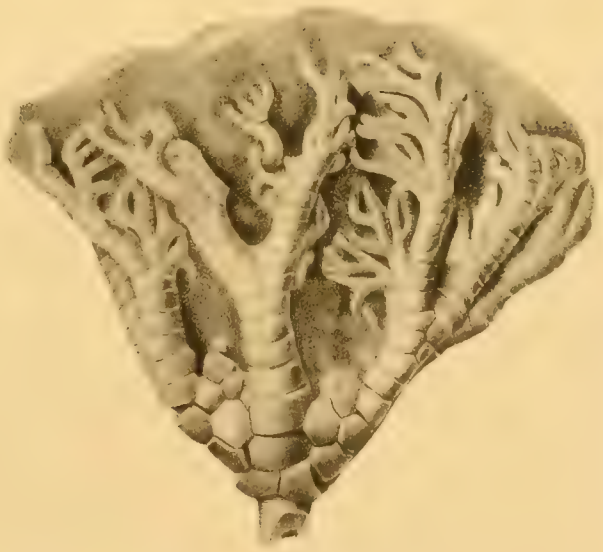

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PLATE LXVII

THE VENTRAL STRUCTURES OF ONYCHOCRINUS

(All figures natural size except where otherwise stated) PAGE

Figs. 1-10. **Onychocrinus ulrichi** Miller and Gurley..... 425

(Also on Plates XXI, LXVI and LXVIII)

FIG. 1. Dorsal view of a specimen showing infrabasals in place, form of posterior basal, and anal tube.

2*a*. Ventral view of specimen with tegmen preserved and partly in place.

2*b*. Central part of same, enlarged. The finely plated integument or perisome is well preserved, although displaced; some ambulacra, with their long alternating plates, can be seen coming in from the rays. The orals, with the large posterior one and the strong supporting plates leading along the posterior ambulacra in place, and the anal tube with the folded perisome attached to it, are beautifully preserved. It can be readily seen from this specimen that if the tegmen were lifted to its proper height, this row of strong articulated anal plates would form a firm but pliant support for a fold or groove in the perisome constituting the rectum. × 2.

3*a*. Similar specimen with the anal series of plates lying behind the posterior oral, and attached as far as the distal end.

3*b*. Detail of distal end of tube and contiguous parts, enlarged and drawn from a different angle. × 2.

4. Posterior basal and anal tube from another specimen, showing the manner in which the perisome is attached to the ventral margin of the plates. At the upper part, where the tube is fallen over to the right, the perisome has slipped away from the plates, and the sloping groove at their margin by which it was attached is plainly seen. × 2.

5. Inner side of detached anal series from another specimen near the distal end, with the folded perisome attached forming a tube, now flattened by pressure; *a*, cross-section of plate and perisome. × 2.

6. Inner lateral view of part of a tube (of *O. exsculptus*) showing the sloped and grooved margin for attachment of perisome. × 2.

7. Ventral view of a specimen with tegmen almost perfectly preserved. Shows the perisome, ambulacra and oral plates in position. The anterior and lateral orals (one being pushed in under another and scarcely visible in this view) form a pyramid meeting the smaller end of the enormous posterior oral. The ambulacra enter between the orals, which evidently were opened or closed at will; the two posterior ambulacra follow the edge of the posterior oral and are further supported by plates partly seen at the left, but which are better shown in fig. 2*b;* the posterior oral is perforated, and exceptionally in this specimen is transversely divided. The anal tube is but little exposed here, lying under the edge of the oral.

8. View of the under side of the same structures in another specimen, seen from the dorsal side, with the calyx plates removed. The open space where the ambulacra converge into the oral pyramid is shown.

9*a*. The oral plates and adjacent perisome in another specimen, showing perforation of the posterior oral. The small orals are not well exposed here, and a foreign object lies next to them at one side. × 4.

9*b*. Detail of same, showing relative size of pores. × 8.

10. Another specimen with the complete tegmen preserved; the anal tube is in its usual position turned to the right and behind the oral.

Figs. 11. **Onychocrinus diversus** M. and W..... 423

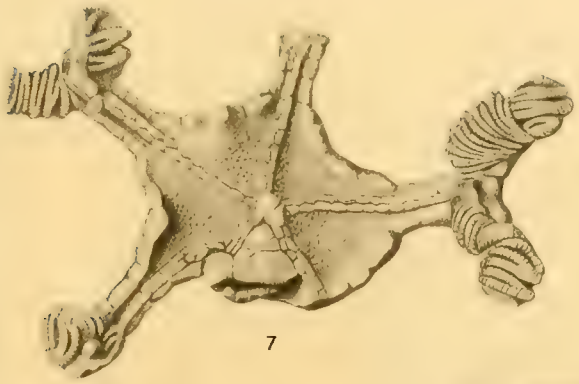
(Also on Plate LXV)

FIG. 11*a*. Calyx of a specimen from Burlington, with rays broken off, and all tegminal and anal structures removed. Posterior view, showing the exact form of post. B, with socket for support of anal tube half way down the outer side and to right of middle, the distal margin not being indented for its reception.

11*b*. Ventral view of same. Shows distal margin of post. B thinned to a sharply rounded edge, with no face for sutural attachment; also similar condition of adjacent brachials.

Unless otherwise stated, Keokuk Gr.; Lower Carboniferous. Indian Creek, Indiana.

All specimens figured on this plate are in the author's collection.



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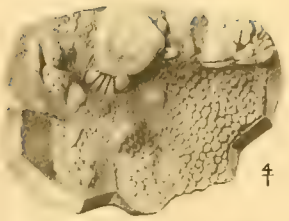

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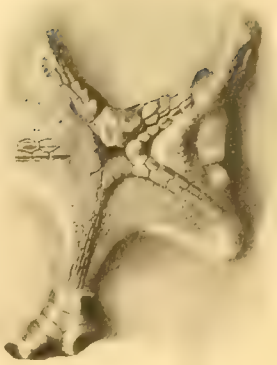

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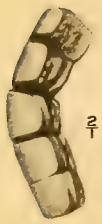

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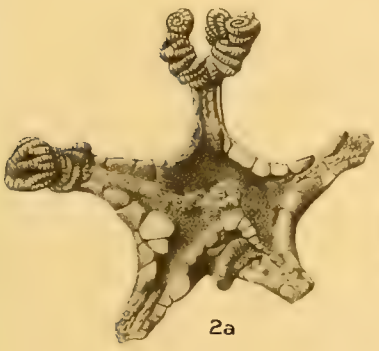

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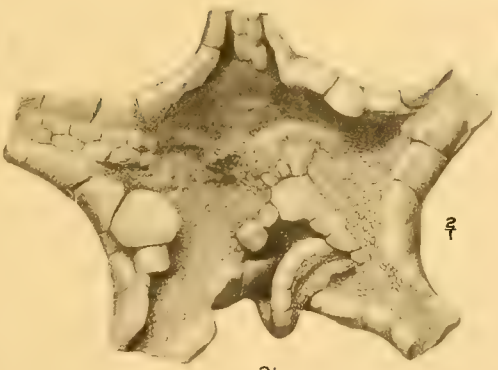

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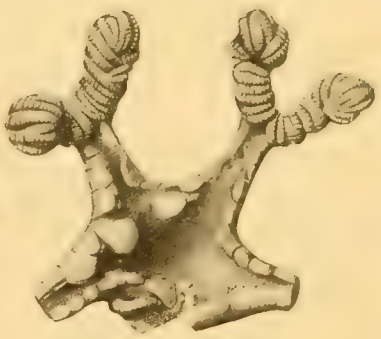

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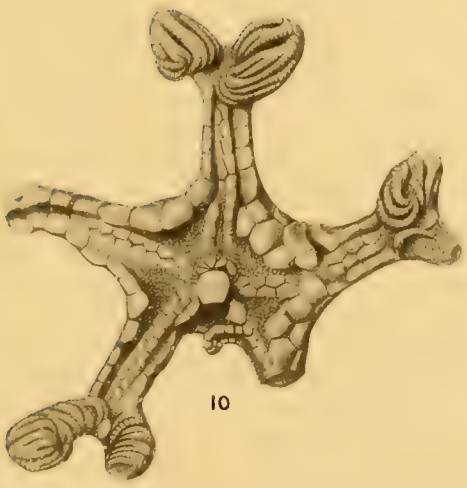

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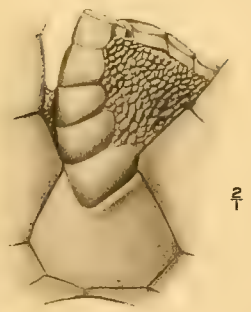

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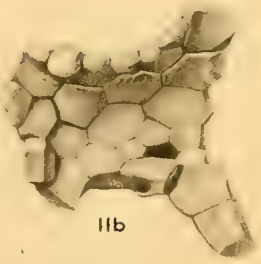

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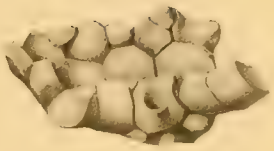

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PLATE LXVIII

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-6. **Onychocrinus ulrichi** Miller and Gurley..... 425

(Also on Plates XXI, LXVI and LXVII)

FIG. 1. Ventral view of a large specimen, with rays widely spread; part of tegmen, oral plates, and anal tube preserved.

2, 3. Two less mature specimens showing the ventral structures.

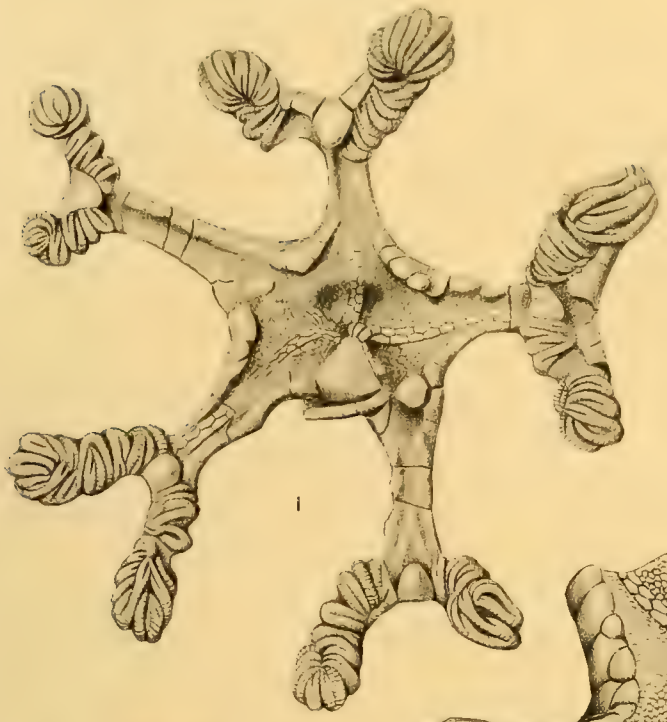
4. Ventral view of another large specimen, with interbrachials profusely developed and strongly contracted notwithstanding the rays are widely spread; a more mature individual than that of fig. 1. Comparison of this with figures on this and preceding plate shows that in addition to the extension of the rays there was a considerable expansion and contraction of the calyx walls themselves due to up and down movements of the viscera.

5. Dorsal view of an expanded specimen showing the general form and proportions of calyx and rays when fully distended; anal tube first impinging upon left posterior radial before bending to the right.

6. Reconstruction of the calyx, based upon the above and other specimens; to show the ambulacra, oral and supporting plates, and the anal tube, in their probable positions when the rays were spread and the orals closed (see also text-figure 8 showing variation in position of anal tube due to contraction of calyx).

Keokuk Group, Lower Carboniferous. Indiana.

All from Indian Creek, Indiana, and in the author's collection.



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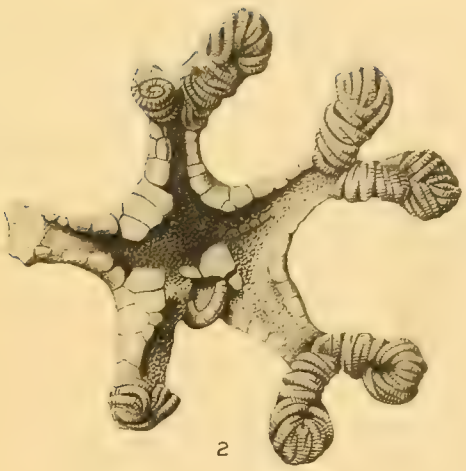

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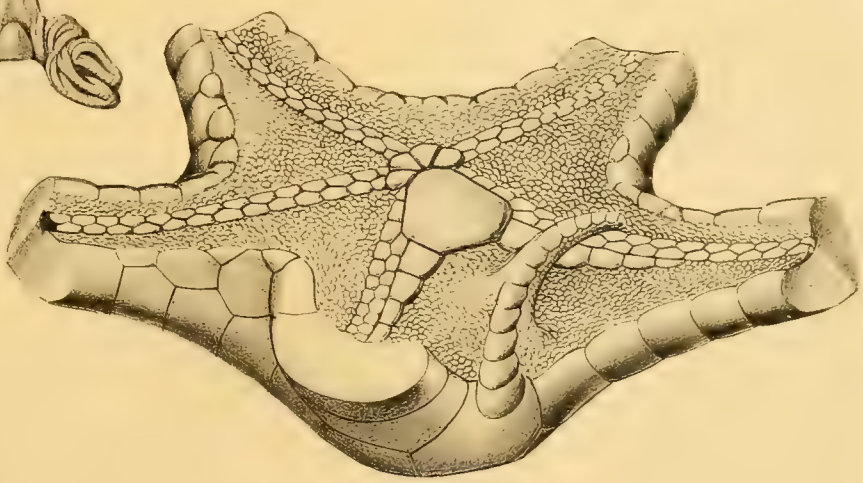

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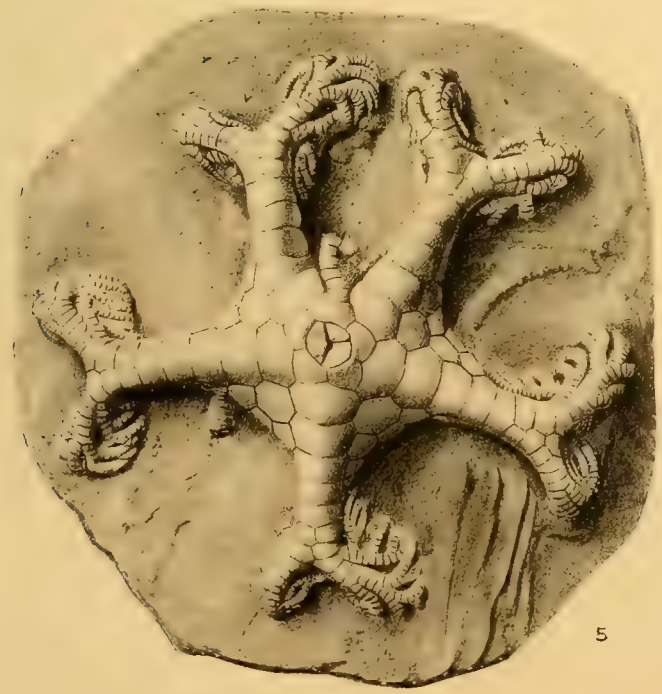

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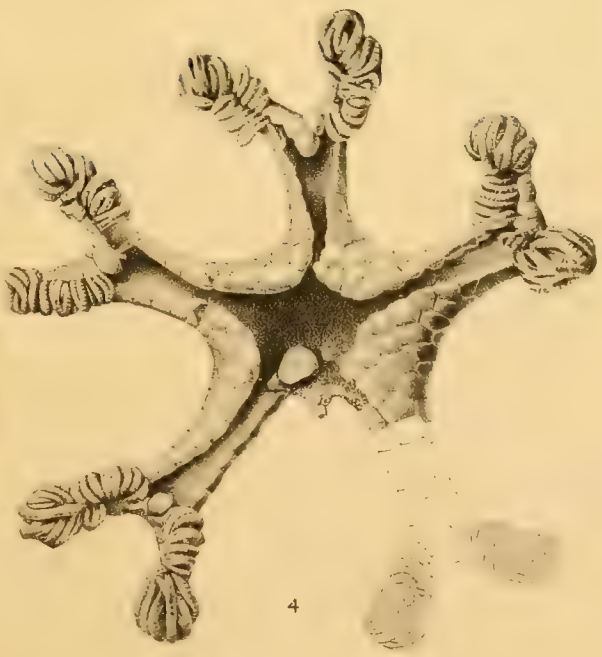

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PLATE LXIX

PAGE

Figs. 1-9. **Onychocrinus exsculptus** Lyon and Casseday..... 430

(Also on Plates LXX and LXXI)

FIGS. 1, 2. The principal type specimens, from unpublished drawings made by Col. Sydney S. Lyon. Author's collection.

3. Another specimen used by Lyon in the description, additionally cleaned; showing part of the tegmen, with ambulacra and perisome preserved. Author's collection.

4. Posterior view of a specimen with rays broken off, showing form of posterior basal, and the strong anal tube with perisome attached to its margin. Note the extreme lateral position of the socket on posterior basal in this and in fig. 8. Author's collection.

5. Ventral view of a specimen with tegmen preserved; showing perisome, ambulacra, posterior oral and its supporting plates, and part of the anal tube. The small orals cannot be identified. Author's collection.

6. Dorsal view of a perfect crown, showing the form and proportions of the calyx and rays when extended. The very slender ray divisions and delicate ramules are in marked contrast to those of the preceding species. Author's collection.

7. The type of *Onychocrinus monroensis* M. and W., from the Keokuk limestone of Monroe County, Illinois—probably a young specimen of *O. exsculptus*. University of Illinois.

8. A rather robust specimen of the same type as last, from the same beds at Keokuk, Iowa. Remnants of the very small ramules are seen in several places, and those that appear larger are drawn much too large, being poorly defined in the matrix. Author's collection.

9. The type of *O. norwoodi* M. and W., from the Keokuk beds at Nauvoo, Illinois; a mature specimen probably of this species, having 5 IBr exceptionally in one ray. University of Illinois.

Keokuk Gr.; Lower Carboniferous. Crawfordsville, Indiana, except as otherwise stated.

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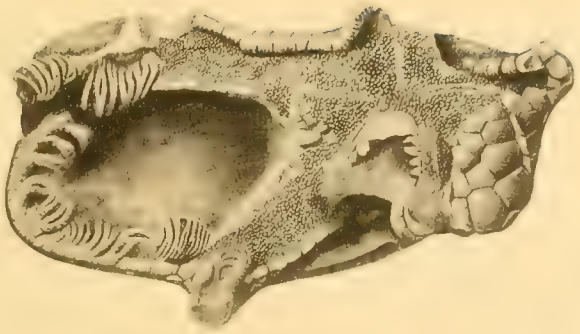

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PLATE LXX

(All figures natural size)

PAGE

Figs. 1-7. **Onychocrinus exsculptus** Lyon and Casseday..... 430

(Also on Plates LXIX and LXXI)

FIG. 1. Posterior view of a very mature and perfect specimen, showing all the characters of the species; especially the anal structures, the long, tapering ray divisions and delicate ramules. The rami are united to third range above axillary.

2. Similar specimen, anterior view; showing the interbrachial structures with their crescentic distal margin in perfect condition.

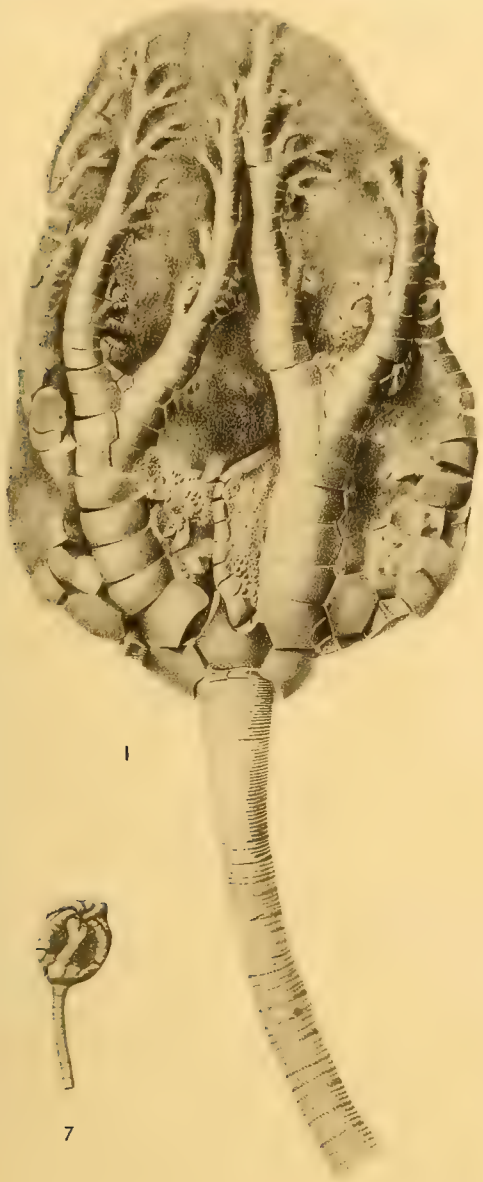
2*a*. Diagram of a ray, showing decrease in number and size of ramules distally.

3. A less mature specimen, with stem nearly complete, showing scattered cirri toward the distal end; rami united for two ranges.

4, 5, 6, 7. A series of successively younger specimens with interbrachials diminishing to one plate, and the rami finally united by only part of one pair of plates. The juvenile character of the stem is well shown in figs. 5 and 6, where it rapidly passes into long columnals.

Keokuk Gr.; Lower Carboniferous. Crawfordsville, Indiana.

All the specimens are in the author's collection.



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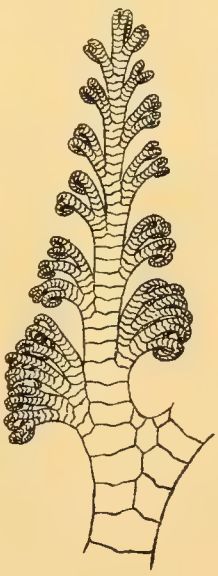

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PLATE LXXI

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PAGE

Figs. 1, 2. **Onychocrinus exsculptus** Lyon and Casseday..... 430

(Also on Plates LXIX and LXX)

FIGS. 1, 2. Two specimens lying side by side on a slab. One is very large, with stem and root complete—about 20 inches long—and the other smaller, with stem nearly complete, and showing small cirri from a greater distance from the root than the former. Both are mature specimens, with short columnals throughout the stem. The figures are reduced to nearly one-half diameter, as shown by scale accompanying. Author's collection.

Keokuk Gr.; Lower Carboniferous. Crawfordsville, Indiana.

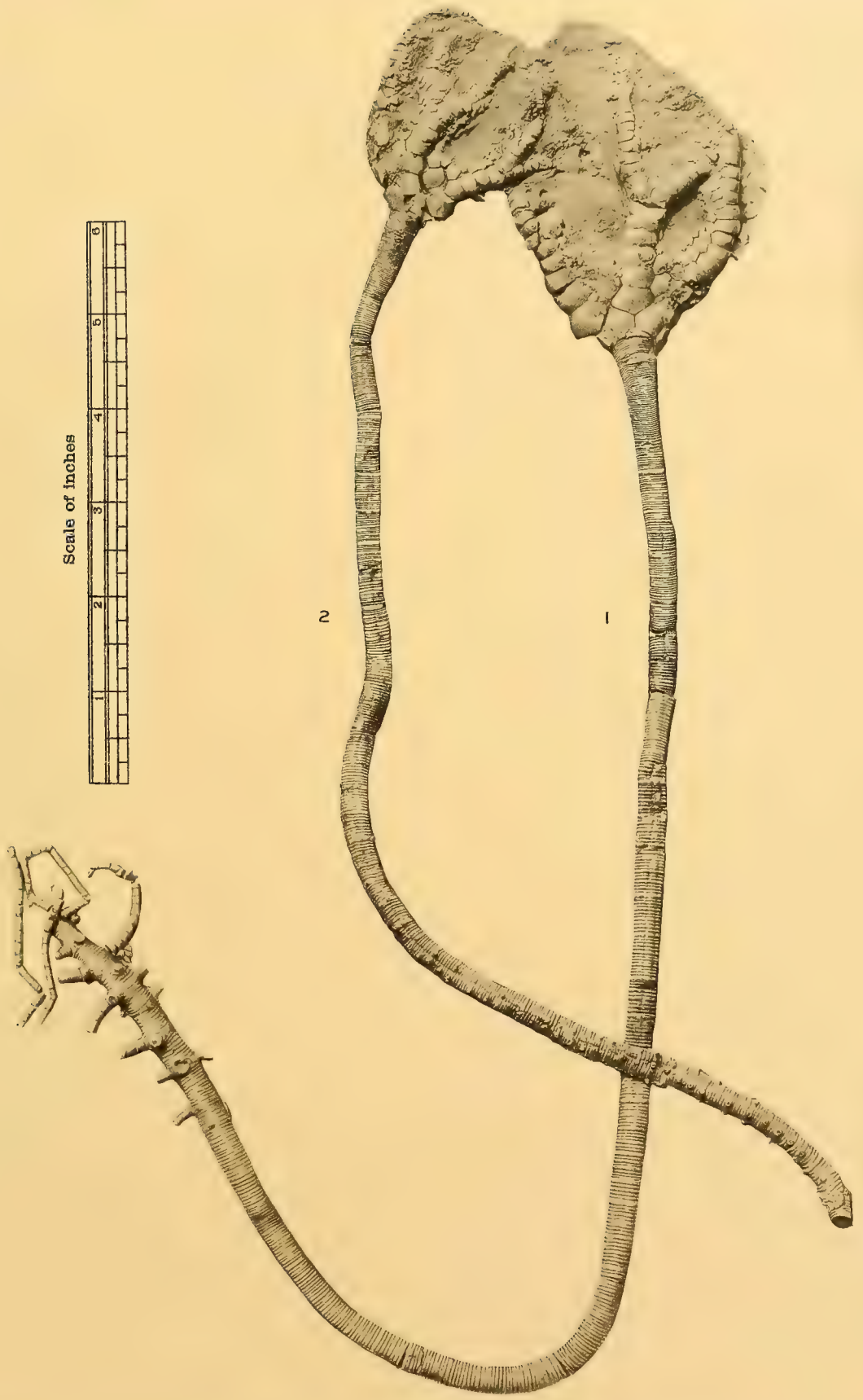

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PLATE LXXII

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Figs. 1-12. **Onychocrinus ramulosus** (Lyon and Casseday) 433

FIG. 1. The principal type specimen used in the original description; anterior view. From an unpublished drawing made by Lyon accompanying his MS. It shows the long, stout ray divisions and ramules; 3 IBr; and 4 or more IIBr.

2a. Posterior view of an extremely mature and remarkably perfect specimen; showing the relatively small anal tube, and the extraordinary development of higher interbrachial structures, which continue in this specimen to the eighth axil; the bilateral ramules with subdivisions up to five; and the profuse occurrence of arcuate sutures, with the processes outlined so as to appear like plates.

2b. A primary interbrachial area, constructed from a similar large specimen.

3. Anterior view of a similar specimen, showing rays to their ultimate divisions. The interbrachials in this and the preceding specimen, while abundant at the axils within the rays, are relatively much less developed at the primary axil than in other species.

4, 5, 6, 7, 8, 9. A series of younger specimens down to those in which no interbrachials whatever are found. That of fig. 5 is labeled in the Lyon collection as from Barren County, Kentucky.

10. Section of a bent ray from IBr upward ground off on the curve, to show that notwithstanding their outward curvature and the appearance of "patelloid plates," the sutures a short distance below the surface are perfectly straight.

11. Abnormal specimen with left anterior ray unbranched.

12. Abnormal specimen having 6 rays;—an extra double ray being wedged in above the radials at the left posterior interbrachial area.

Keokuk Gr.; Lower Carboniferous. Crawfordsville, Indiana, except as otherwise stated.

All specimens are in the author's collection.

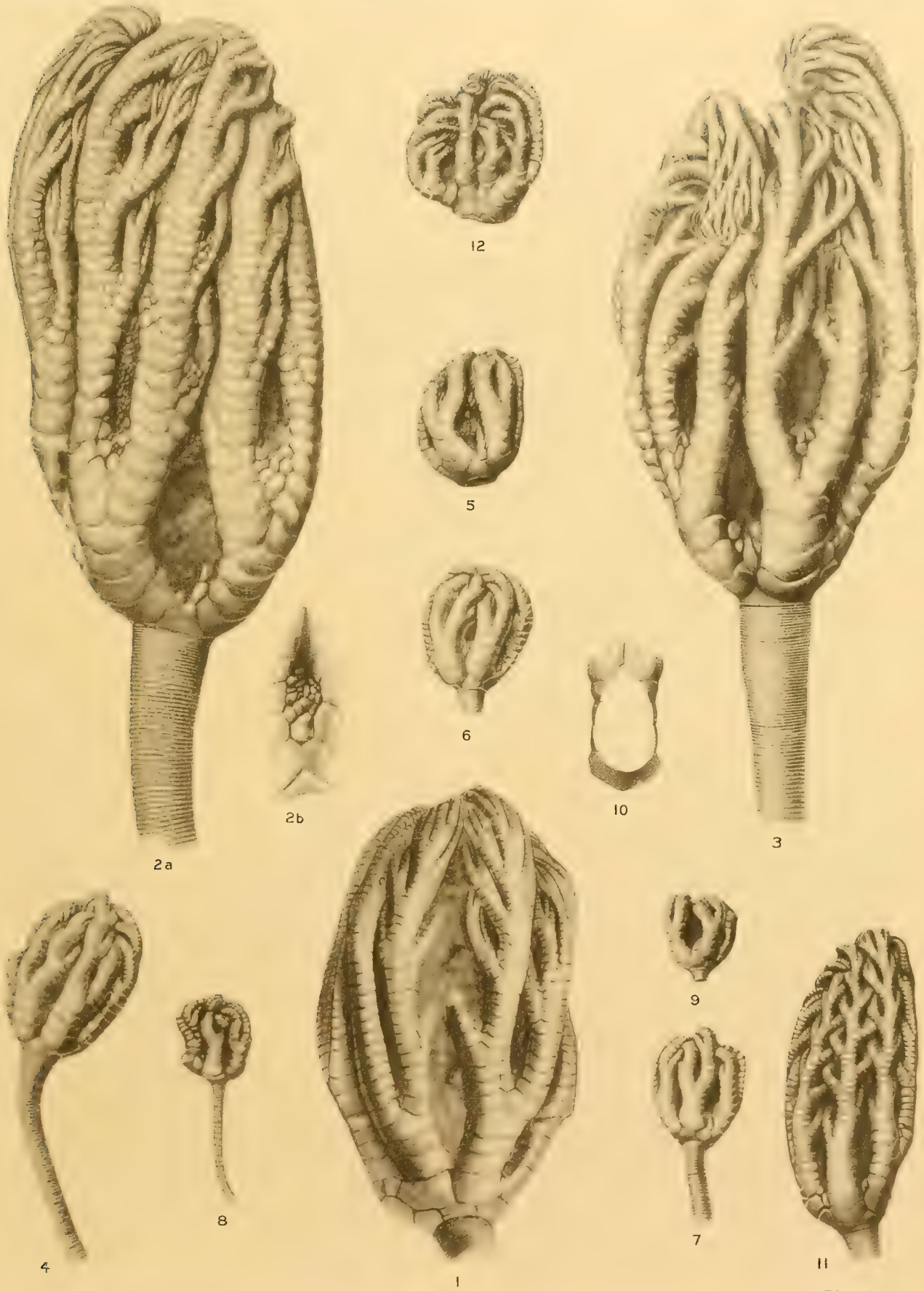

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PLATE LXXIII

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Figs. 1-4. **Onychocrinus magnus** Worthen..... 433

FIG. 1. The type, after additional cleaning, exposing the ramules not shown in the original figure; a very mature and somewhat robust specimen. Illinois State Museum, Springfield. Monroe County, Illinois.

2a. Mature specimen from St. Louis; posterior view, showing the small anal tube, with bordering perisome; large primary interbrachial followed directly by finely plated perisome; the relative size and proportions of rays and their main branches; and the succession of clusters of ramules. Has 3 IBr in anterior ray. Author's collection.

2b. Outline in part of left lateral ray, which is less eroded by weathering, showing the arcuate sutures.

3. Anterior view of another specimen from same locality having but 3 IBr in all the rays.

4. Lateral view of a less mature specimen from same locality, having no iBr in the second axil; has 3 IBr in one ray. Author's collection.

St. Louis Gr.; Lower Carboniferous. Illinois.

Figs. 5-8. **Onychocrinus distensus** Worthen..... 436

FIGS. 5, 6. Specimens from Huntsville, Alabama, in strata equivalent to the Renault beds of Illinois. In fig. 5 the ray to the left has 15 clusters of ramules on each ramus, not all visible in this view. Author's collection.

7. Type of *Forbesiocrinus semiovatus* M. and W., from Hardin County, Illinois; a young and obscure specimen belonging to *Onychocrinus,* and perhaps to this species. University of Illinois.

8. Type of *O. distensus,* from the Renault formation, lower part of the Kaskaskia, Monroe County, Illinois. Illinois State Museum, Springfield.

Renault formation and its equivalent, lower part of Kaskaskia; Lower Carboniferous. Illinois and Alabama.

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PLATE LXXIV

(All figures, except fig. 10, natural size)

PAGE

Figs. 1-10. **Onychocrinus pulaskiensis** Miller and Gurley..... 437

(Also Plate LXXV, figs. 15*a*, *b*)

FIG. 1. The type; antero-lateral view. University of Chicago.

2. A very mature, complete specimen, with r. post. ray slightly malformed. It is of the type of *O. ramulosus*, with 3 IBB, and small anal structures, but without interbrachials in the higher axils; ramules at every second or third brachial; and nodes on axillary brachials—most of them removed by erosion.

3. Mature specimen, with nodes on the arms well marked; base crushed vertically.

4, 5. Posterior and anterior views of less mature specimens with stems attached; fig. 4 shows a ramule on every second brachial in many places.

6. Smaller specimen, with good sized iBr; anterior view.

7. A very young specimen with no iBr; l. post. view.

8. Type of *Onychocrinus parvus* M. and G., a very young individual perhaps of this species. University of Chicago. Martin County, Indiana.

9. Stem with IBB fused to top columnal; by oversight, the small IB is drawn to left side instead of right.

10. Inner floor of IBB of another specimen; showing the funnel, and the course of the 5 interradial passages down into the stem. × 4 (enlargement fraction omitted on plate). Kaskaskia Gr.; Upper beds, Lower Carboniferous. Pulaski County, Kentucky, unless otherwise stated.

All specimens, except those of figs. 1 and 8, are in the author's collection.

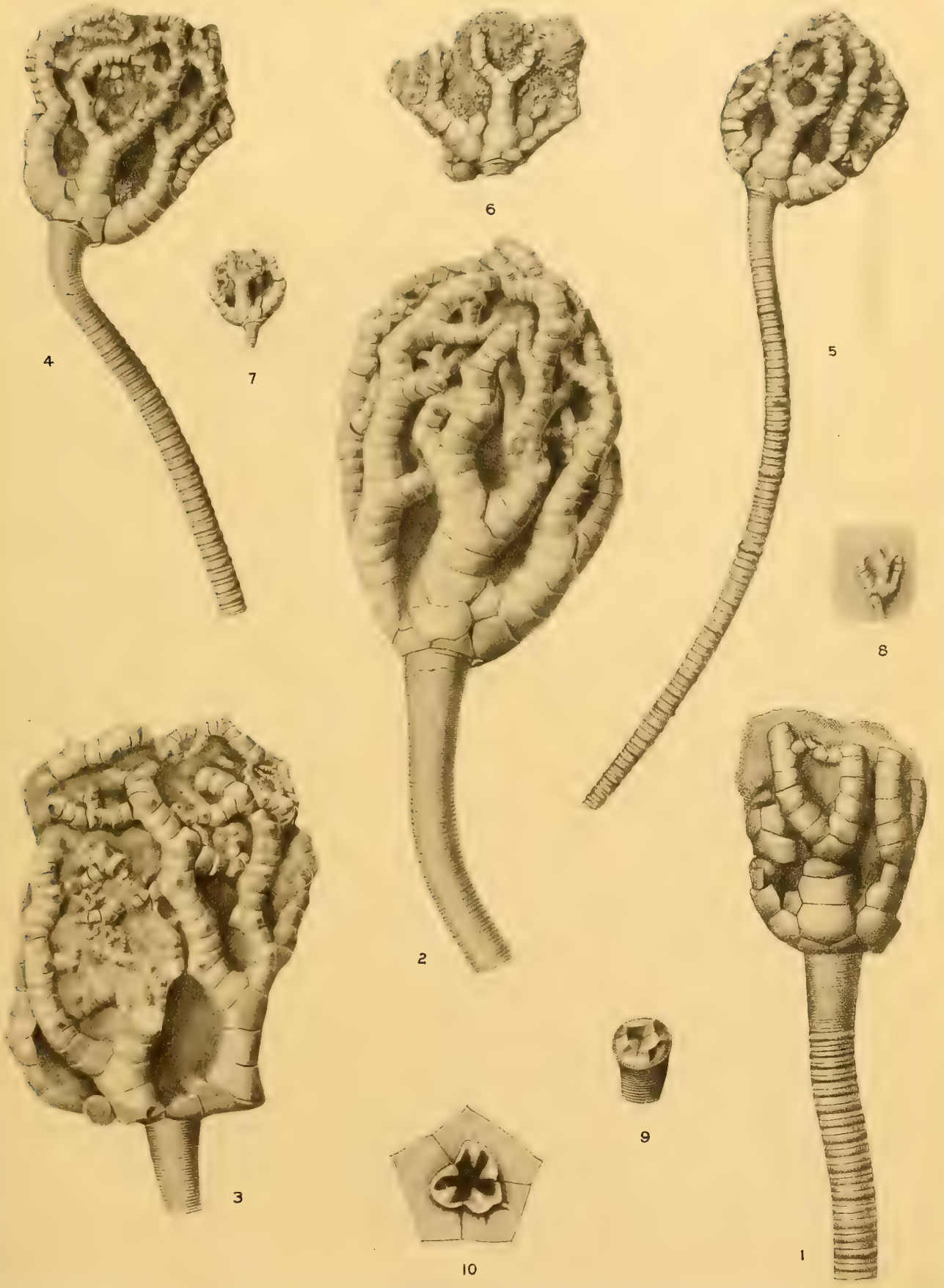
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PLATE LXXV

(All figures natural size except where otherwise stated)

PAGE

Fig. 1. **Ptilocrinus pinnatus** A. H. Clark.....49, 52

(For comparison of interbrachial structures and tegmens)

FIG. 1*a*. Left anterior interradial view of calyx with part of stem; showing the interbrachial perisome and the tegminal ambulacra in profile. × 2.

1*b*. Posterior view of same; showing anal opening at the apex; holes made by the boring parasite, *Eulima ptilocrinicola* Bartsch. × 2.

1*c*. Tegmen of same; the wide ambulacra, and relatively small orals separated from radials and pushed to the center by extensive growth of perisome, the posterior one differentiated by contact with plates surrounding the anal opening. × 4.

Recent: 1588 fathoms. Albatross, Cruise of 1890, North Pacific.

Figs. 2-4. **Cupulocrinus jewetti** Billings.....88, 89

(Illustrating a possible Inadunate ancestral type for the Flexibilia. Figs. 2 to 6 reproduced from the author's paper on A Trenton Echinoderm Fauna, 1910.)

FIG. 2*a*. Anterior view of calyx; showing the short and wide IBr and IIBr with strongly arcuate sutures; and small plates of interbrachial perisome between the rays.

2*b*. Posterior view of same, showing large RA under r. post. R; and beginning of the anal series.

3. Posterior view of a specimen with arms; showing RA, and the vertical anal series separated from adjacent rays by perisome; arcuate sutures strongly marked.

4. Posterior view of another specimen, showing the anal tube, with dorsal median series of large plates, curving distally upon the perisomic integument which borders it for its full length.

Trenton; Ordovician. Kirkfield, Canada.

Fig. 5. **Cupulocrinus humilis** Billings.....88, 89

FIG. 5. A specimen showing tapering stem, and interbrachial perisome beginning with a fairly definite large plate in the axil. × 2.

Horizon and locality same as last.

Figs. 6*a*, *b*. **Cupulocrinus minimus** n. sp..... 88

FIG. 6*a*. Posterior view of specimen, with median anal series curving upon the tegmen and merging into perisome only a short distance above the first ray bifurcation. × 2.

6*b*. Distal view of same. × 2. A recurrent Trenton type from the Waynesville formation of the Richmond group.

Silurian. Waynesville, Ohio.

Figs. 7, 8. **Reteocrinus nealli** (Hall)..... 90

(For comparison as transition type of Camerata)

FIG. 7. Posterior view of calyx, with undifferentiated tegmen of small plates; median anal series bordered by perisome and leading to anal opening at margin of tegmen. × 2.

8. Oblique r. post. view of another specimen, with tegmen more directly seen; anal opening at the left. Note the entire absence of ambulacra.

Silurian. Waynesville formation of the Richmond group. Morrow, Ohio.

Fig. 9. **"Caleidocrinus" multiramus** Barrande..... 442

(Also on Plate LXXVI, fig. 24)

FIG. 9. A specimen from Zahoran, Bohemia, in which the substance of the plates is preserved; showing the general form of crown and stem, low BB, and broad base. Belongs to *Iocrinus;* see Pl. LXXVI, fig. 24, for structure of anal side.

Ordovician, Etage D4.

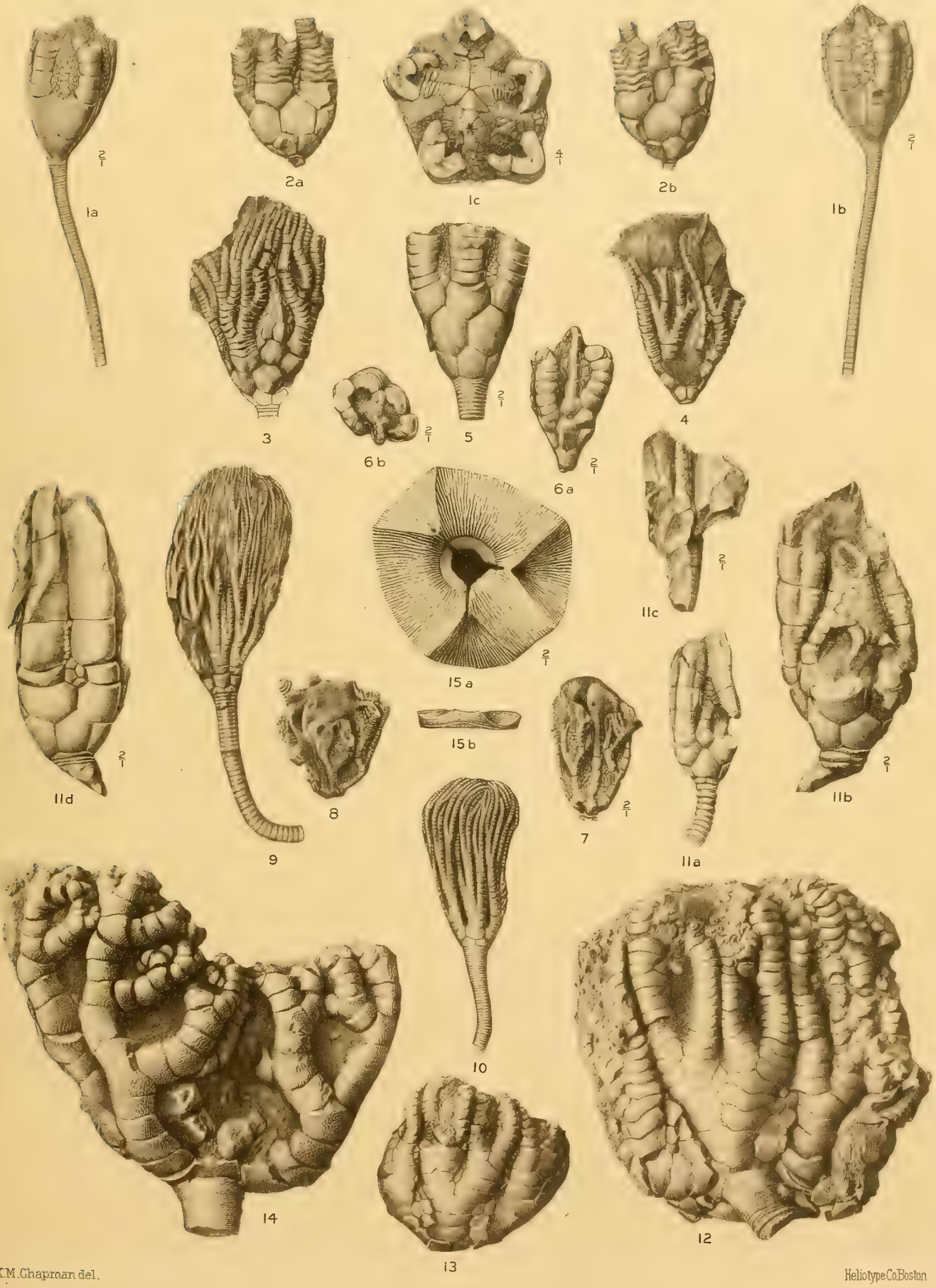
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Fig. 10. **Eutaxocrinus pulcher** n. sp. 369

FIG. 10. Lateral view of flattened crown with part of stem, showing flowing lines and graceful contour. New York State Museum.
Chemung; Upper Devonian. Belmont, New York.

Figs. 11*a-d*. **Rhopalocrinus gracilis** (Schultze) 453

FIG. 11*a*. Posterior view of the type, with stem as in Schultze's original figure. The infrabasal suture here shown, inadvertently copied from Schultze, is incorrect; the base is undivided. Mus. Comp. Zool., Harvard.

11*b*. Right posterior view of same, with ray and upper part detached, showing the strong ventral tube or sac. × 2.

11*c*. Inner side of detached part, showing in oblique cross-section continuation of the ventral sac. × 2.

11*d*. Left anterior interradial view of entire crown, showing interbrachial plates. Note the shortness of the first IBr. × 2.
Middle Devonian. Pelm, Eifel, Germany.

Figs. 12, 13. **Synerocrinus incurvus** Trautschold 336
(Also on Plate XLII)

FIG. 12. A mature, flattened specimen; showing occurrence of this Russian species in Scotland. Coll. James Wright, Jr. Roscobie.

13. A young specimen from Ardross. Same collection.
Hurlet limestone, top of Lower Carboniferous. Fifeshire, Scotland.

Fig. 14. **Onychocrinus wrighti** n. sp. 438

FIG. 14. Posterior view of the type. Coll. James Wright, Jr.
Hurlet limestone, top of Lower Carboniferous, Inverteil, Scotland.

Fig. 15. **Onychocrinus pulaskiensis** Miller and Gurley 437

FIG. 15*a*. Distal face of a large radicular cirrus-bearing stem ossicle, showing mode of attachment of the irregularly disposed cirri, here three in number; surface crenulae arranged in two series, the cirrus crenulae in the triangular depressions radiating from the cirrus branches of the axial canal, and the stem crenulae in the sub-rectangular positions, radiating from the main axial canal. Shape of the axial canal is modified by the cirrus-canals, which diverge from it obliquely; owing to the presence of only three cirri it is here triangular in general outline, whereas if there were five cirri it would be pentagonal.

15*b*. Lateral view of same, showing cirrus depressions in profile, and deformation of the proximally attached stem ossicle.
Kaskaskia Gr.; Lower Carboniferous. Pulaski Co., Kentucky.

All specimens in the author's collection unless otherwise stated.

PLATE LXXVI

(All figures natural size except where otherwise stated)

PAGE

Figs. 1-5. **Edriocrinus dispansus** Kirk..... 449

FIG. 1. The type. Posterior view of calyx; anal plate projecting above RR. ×$\frac{3}{2}$. U. S. Nat. Mus.
2. Ventral view of another calyx, showing great contraction at arm-bases. ×$\frac{3}{2}$.
3. Ventral side of basal disk; showing interbasal sutures and 4 BB; also angular ridges between depressions for radial and anal plates. ×$\frac{3}{2}$.
4. Dorsal view of rounded basal disk, with indented cicatrix of attachment in younger stage. ×$\frac{3}{2}$.
5. Dorsal view of another base which has far outgrown the shell to which it was attached. ×$\frac{3}{2}$.

Helderbergian; Lower Devonian. Benton County, Tennessee.

Figs. 6-12. **Edriocrinus occidentalis** n. sp..... 449

FIGS. 6-9. Silicified specimens from Covington, Virginia, showing different forms and sizes of base.
10, 11. Similar specimens from Stewart County, Tennessee. ×$\frac{3}{2}$.
12. Transversely fractured base from last locality, showing the position of interbasal sutures replaced by silicious partitions; and of the 4 BB. ×$\frac{3}{2}$.

Helderbergian; Lower Devonian. Virginia and Tennessee.

Figs. 13-15. **Edriocrinus explicatus** n. sp..... 449

FIG. 13. Lateral view of base; calcareous specimen, in which the interbasal sutures are visible at the surface. ×$\frac{3}{2}$.
14-15. Dorsal and distal views of similar bases, showing 4 BB. ×$\frac{3}{2}$.

Helderbergian; Lower Devonian. Perry County, Tennessee.

Figs. 16-18. **Edriocrinus adhaerens** n. sp..... 451

FIGS. 16-18. Three specimens of bases attached to shells or other objects; showing the expanded lower surface, and the angular ridges (6 in number) between depressions for radials and anal plate. ×$\frac{2}{1}$.

Helderbergian; Lower Devonian. Benton County, Tennessee.

Figs. 19-21. **Edriocrinus pyriformis** Hall..... 451

FIG. 19. One of the three types used in Hall's description, original of fig. 1, p. 115, of the 15th Report. Left posterior view of calyx; concave surface of attachment at lower end of basals. Am. Mus. Nat. Hist.
20. Distal view of another type, showing inward bending of radials at arm bases, and the projecting anal plate. Same collection.
21. Concave lower surface of another base. Same collection.

Helderbergian; Lower Devonian. Oneida County, New York.

Figs. 22, 23. **Edriocrinus holopoides** n. sp..... 452

FIG. *22a*. Anterior view of complete crown; showing 4 and 5 IBr, broad low calyx, and encrusting base. ×$\frac{3}{2}$.
22b. Basal view of same, showing course of interbasal sutures between 4 BB. ×$\frac{3}{2}$.
23a. Posterior view of another specimen with 6 IBr, showing projecting anal plate, short arms, and narrowness of crown.
23b. Basal view of same, showing traces of interbasal sutures.

Fig. 24. **Iocrinus ("Caleidocrinus") multiramus** (Barrande)..... 442

(Also on Plate LXXV, fig. 9)

FIG. 24. Posterior view of specimen showing series of anal tube plates originating on left shoulder of axillary r. post. super-radial. The stem proximal to the calyx is pentagonal, but somewhat flattened. Negative photograph of original impression left by decomposition of the fossil. ×$\frac{3}{1}$.

Ordovician. Zahoran, Bohemia.

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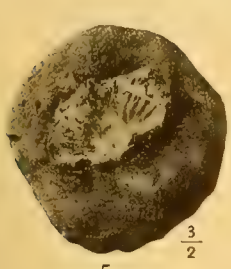
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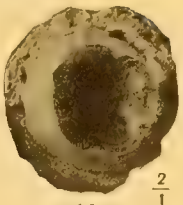
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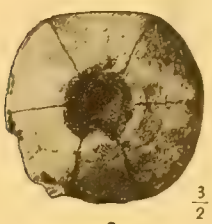
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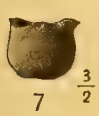
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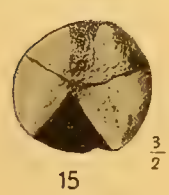
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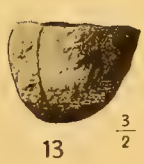
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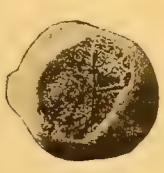
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